

# IN WATER INVESTIGATION REPORT

## BRADFORD ISLAND LANDFILL Cascade Locks, Oregon

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# LIST OF ABBREVIATIONS

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µg/L	micrograms per liter
Å	angstrom
AQUIRE	USEPA's aquatic toxicity database
ARCS	Assessment and Remediation of Contaminated Sediment Project
AWQC	ambient water quality criteria
bgs	below ground surface
BPA	Bonneville Power Administration
CCC	Criterion Continuous Exposure
CMC	Criterion Maximum Exposure
COI	chemicals of interest
DOC	dissolved organic carbon
GPS	global-positioning system
IDW	investigation-derived waste
ISQGs	Canadian Sediment Quality Guidelines for the Protection of Aquatic Life-Interim Freshwater Sediment Quality Guidelines
LDPE	low-density polyethylene
LOEC	Lowest Observed Effects concentrations
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MS	matrix spike
MSD	matrix spike duplicate
msl	mean sea level
NOAA TEL	National Oceanic & Atmospheric Administration Freshwater Sediment Ecological Threshold Effects Level
NOEC	No Effects Concentrations
NTU	Nephelometric Turbidity Units
New York LEL	New York State Sediment Lowest Effect Level for Metals
Ontario LEL	Ontario Ministry of the Environment Lowest Effect Level
ORNL SCV	Oak Ridge National Laboratory Secondary Chronic Values
OSWER	Office of Solid Waste and Emergency Response
PAHs	polycyclic aromatic hydrocarbons
PCBs	polychlorinated biphenyls
Puget Sound NEL	Puget Sound Tributyltin No Adverse Effect Level
QA/QC	quality assurance/quality control
Region 9	Environmental Protection Agency, Region 9
SAP	sampling and analysis plan
SPMD	semi-permeable membrane devices
SVOCs	semivolatile organic compounds
TBT	tributyltin
TEC	Threshold Effect Concentration
TOC	total organic carbon
URS	URS Corporation
USACE DART	U.S. Army Corps of Engineers Data Access in Real Time
USACE	U.S. Army Corps of Engineers
USCS	Unified Soil Classification System
USFW	United States Fish and Wildlife Service
USGS	U.S. Geological Survey
VOCs	volatile organic compounds

## LIST OF ABBREVIATIONS

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WA State	Washington State Sediment Quality Criteria “No Effects” level
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## 1.0 INTRODUCTION

During hydrographic and underwater dive surveys conducted in October and November 2000, the U.S. Army Corps of Engineers (USACE) identified the presence of waste-related items, including electrical items that contain polychlorinated biphenyls (PCBs), submerged in the Columbia River adjacent to the Bradford Island Landfill. The dive surveys were conducted following the discovery of electrical items at the water's edge during landfill investigations. Some of these waste-related items were removed in December 2000. Analytical chemistry results from the sediment sampling conducted during the December 2000 recovery operations indicated the presence of PCBs. The USACE intends to conduct an additional investigation to identify any additional impacts and to assist in the development of the waste removal design.

The Bradford Island Landfill is a former waste disposal site at the Bonneville Lock and Dam Project near Cascade Locks, Oregon. The landfill was used from the early 1940s until the early 1980s.

The USACE owns the landfill, and is investigating the site, under the oversight of the Oregon Department of Environmental Quality (DEQ), through the Voluntary Cleanup Program.

USACE contracted with URS Corporation (URS) to conduct the additional investigation of the near-shore area of Bradford Island under Contract DACW57-99-D-0005, Delivery Order No. 0004. The work was completed in accordance with the statement of work in the delivery order, and in accordance with the work plan (URS, 2001a) and the sampling and analysis plan (URS, 2001b).

## 2.0 SITE LOCATION AND FEATURES

Bradford Island is part of the Bonneville Lock and Dam Project. At the island's location, the Columbia River forms the border between Oregon and Washington (Figure 1). The landfill site is in the northeast corner of Bradford Island upstream of Bonneville Dam and is located within the State of Oregon. The site is within the southwest quadrant of Section 22, Township 2 North, Range 7 East, Willamette Meridian. The site is not currently part of the routine operation of the Bonneville Lock and Dam, and is managed long term as a wildlife habitat for geese under the Bonneville Master Plan. No change from that land use is expected in the foreseeable future. Figure 2 shows the location of the landfill and the portion of the river investigated during the recent work.

The elevation of the ground surface at the landfill is approximately 110 feet above mean sea level (msl). The normal elevation of the Bonneville pool is 72 feet msl.

The ground surface of the landfill site is relatively flat, sloping gently toward the west where the site access road enters the area. To the south, the ground surface rises moderately to a wooded upland area. To the north and east, the island drops steeply to the Columbia River. Surface runoff from the surrounding area tends to run onto the landfill site.

## 2.1 GEOLOGY AND HYDROGEOLOGY

Subsurface soils at the landfill site consist of unconsolidated silty-sand alluvium underlain by intermixed alluvium and bedrock. Unconsolidated deposits are underlain by sandstone, siltstone, and conglomerate, which is referred to as the "slide block". Soils encountered during previous investigations consisted of brown, well-graded, dense landslide deposits with varying percentages of sand, gravel, and silt. Groundwater has been encountered on the landfill at depths ranging from approximately 11 feet below the ground surface (bgs) to 18 feet bgs.

URS conducted a seep survey along the shoreline on March 4, 2000, intended to identify locations where groundwater discharges to the land surface. The survey included the north, east, and southeast sides of Bradford Island. One small groundwater seep was identified on the north side of the island, approximately 20 feet west of monitoring well MW-5 and approximately 4 feet above the level of the river. On April 13, 2000, the seep discharge rate was measured at approximately 4 gallons per hour, and samples were collected of both the groundwater discharging from the seep, and from the soils immediately beneath the seep location. The soil beneath the seep was orange-brown. Two additional small seeps were observed in the same area on May 2, 2000.

Except for the small seeps described above, groundwater is assumed to discharge to the Columbia River, below the pool level.

## **2.2 BACKGROUND**

The landfill was used as a waste disposal site from the early 1940s until the early 1980s. Waste was reportedly disposed of in several individual pits excavated for this purpose within the landfill area, rather than in a single landfill cell. The upland areas of the landfill, including the storm drain system, are the focus of ongoing site investigative activities.

### **2.2.1 Landfill Investigations**

Previous investigations focused primarily on the landfill itself, and consisted of the site investigation and the supplemental site investigation. On the north edge of the island, waste materials exposed at the surface include concrete rubble, steel cables, a few empty buckets and drums, and miscellaneous trash. On the surface of the landfill, various waste items were observed, including plastic planter buckets, empty cans and paint solids, metallic slag, and partially burned construction debris. Subsurface exploration identified a wide variety of waste including broken glass, ceramic electrical insulators, rubber hose, wood, tires, metal debris, roofing paper, mercury vapor lamps, and pipe.

Analytical results for surface and subsurface soil samples collected from the site showed relatively low concentrations of volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), metals, herbicides, pesticides, and PCBs (URS, 2000). Analytical results from the perched water beneath Bradford Island Landfill identified relatively low levels of VOCs, SVOCs, petroleum hydrocarbons, and metals (URS, 1999).

Two PCB-containing light ballasts were discovered at the landfill site in March 2000. The ballasts are components typical of the electric street lighting system at the Bonneville Lock and Dam. The ballasts are cylindrical steel devices, approximately 18 inches tall and 10 inches in diameter. The first ballast was observed on the north shore of Bradford Island in about 1-foot of water, during the URS reconnaissance for groundwater seeps. The second ballast was discovered by USACE personnel on the north slope of the island. The USACE opened the sealed light ballasts and collected and analyzed samples of a tar-like substance. The tests showed that the ballasts contained PCBs at concentrations of up to approximately 600 milligrams per kilogram (mg/kg).

In March 2001, two additional ballasts, similar to those described above, were discovered along the river shoreline near the groundwater seep. These units have not been tested for PCBs.

Because of the evidence that Bradford Island was formerly used to dispose of light ballasts, the USACE reviewed internal records and estimated that up to 50 ballast units could have been disposed of at the landfill.

### **2.2.2 In-Water Waste Recovery**

The discovery of the light ballasts on the shore of the island led to an underwater survey during October and November 2000. The survey identified several additional electrical items in the

river next to Bradford Island, including light ballasts, electrical insulators, lightning arresters, electrical switches, rocker switches, a breaker box, and electrical capacitors. Most of the waste-related items were observed in piles located on the east and north edges of the island (Figure 3). Divers recovered some of the electrical items. Characterization and off-site disposal of the recovered items has occurred. Other observed non-electrical wastes were a metal pipe, wire rope, concrete, an automobile bumper, and a stove.

In December 2000, approximately 60 electrical items were recovered from the easternmost pile (hereinafter described as “Pile #1”), including post insulators, lightening arrestors, electrical panels, and one interteen capacitor<sup>1</sup>. Sediment samples were collected from areas close to where the electrical items were found. Analytical chemistry tests identified PCBs in the sediment samples at concentrations ranging from 0.15 mg/kg to 8.3 mg/kg. Appendix E contains the technical memorandum that discusses the December 2000 waste recovery activities.

### 2.2.3 Storm Drain System

While the USACE was disassembling PCB-containing transformers in the parking area on the east side of the Bradford Island Sandblast Building on November 22, 1995, approximately 1 quart of PCB-containing oil was released. The oil was spread by stormwater runoff. The release was contained using booms and sorbent pads, and soil samples were collected. At the time of the release, samples were not collected from the storm drain system that may have captured the spill or any runoff from the area. Runoff from the area is captured by the storm drain and conveyed to the Columbia River by underground pipes.

Other site features near the PCB spill that could impact the storm drain include sandblast grit from the sandblast shop and blowdown water generated from a nearby compressor. Figure 4 depicts the approximate location of the storm drain system and identifies surrounding site features.

The USACE is in the process of investigating the storm drain system to determine whether residual contamination remains in the area drained by this system.

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<sup>1</sup> During this survey, the electrical equipment was grouped into 3 separate piles – one to the east and two to the north of the Bradford Island.

### 3.0 PROJECT OBJECTIVES AND APPROACH

#### 3.1 INVESTIGATION RATIONALE AND APPROACH

The purpose of the in-water investigation was to further characterize the underwater debris and any resulting environmental impacts. The investigation area included the area surrounding the previously described piles, an additional survey area down stream of the piles and an upland portion of the island that includes the storm drain system (Figures 3 and 4). The data was also collected to assist the USACE in designing the best method for removing the debris.

The investigation included the following tasks:

- Collection and analysis of five primary water column samples from the area surrounding the underwater debris and an upgradient location<sup>2</sup>.
- Installation, retrieval and analysis of four primary semi-permeable membrane devices (SPMDs) from the area surrounding the underwater debris and from one upgradient location.
- Collection and analysis of six primary sediment samples from the area surrounding the underwater debris.
- Collection and analysis of tissue from two species of near-shore invertebrates.
- Underwater visual survey of the known debris piles to estimate the approximate volume, types of debris, and percent composition.
- Underwater visual survey of an additional survey area downstream of the known piles to identify any other areas of debris.
- Assessment of the storm drain system on the north side of the Sandblast Building, by collecting and analyzing sediment present in the drain catch basins and beneath the outfalls of the two drains.

#### 3.2 CHEMICALS OF INTEREST

Previous investigations at the Bradford Island Landfill identified chemicals of interest (COIs) in the following chemical classes:

- Petroleum hydrocarbons (both gasoline and diesel)
- Pesticides
- Chlorinated herbicides
- PCBs

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<sup>2</sup> Primary samples are collected to meet the objectives of the investigation as distinguished from quality assurance and quality control samples that are collected to characterize data quality.

- Metals
- VOCs
- SVOCs
- Butyltins

The selection of target chemical classes was based on the findings from previous investigations and the potential to be site contaminants based on past practices, rather than comparison of available data to human health or ecological health risk screening values.

### 3.3 DATA QUALITY OBJECTIVES

Data quality objectives (DQOs) are qualitative and quantitative statements that clarify technical and quality objectives, describe the intended use of the data, define the appropriate type of data needed to support the decision, identify the conditions under which the data should be collected, and specify the acceptable level of uncertainty in the data.

The overall DQOs for this investigation were to develop and implement field measurements, laboratory analyses, and reporting that results in data quality that is consistent with its intended use. The intended uses of the data include the following:

- Evaluate sediment chemistry data against screening values and background concentrations.
- Assess the presence or absence of PCBs in near-shore invertebrates.
- Assess whether PCBs present in the sediment could partition into the water column during debris retrieval at concentrations above the ambient water quality screening values.
- Provide information to assist the USACE in developing removal methods for debris.
- Quantify the volume of submerged debris.
- Collect information to help assess if a surface release captured by upland storm drain system has impacted the near-shore sediments.
- Evaluate whether residual contamination is present in the stormwater drain system. Sample results do not verify causation.

### 3.4 OVERVIEW OF SAMPLING AND ANALYSIS PROGRAM

Samples were collected during the May 2001 In-Water Field Investigation. Sample locations and analyses are summarized in Table 3-1. Photos of the work performed are presented in Appendix B. All samples were collected in the manner described in the *Sampling and Analysis Plan, In-Water Investigation, Bradford Island Landfill, April, 2001* (URS, 2001b) unless otherwise specified below.



### 3.4.1 Comprehensive Survey

The survey work was conducted in the submerged near-shore areas north and east of the island between April 30 and May 3, 2001 to identify the presence, type and extent of debris. The survey was conducted in the manner described in the FSP with the following exception. Rather than group the observed waste in three categories (hazardous electrical items, possibly hazardous electrical items, miscellaneous debris), it was grouped into two categories: electrical items (to include lightening arrestors, intertean capacitors, light ballasts, switches, post insulators and other miscellaneous electrical equipment) and non-electrical debris (concrete, wire rope, etc). The distinction between hazardous and possibly hazardous electrical equipment was not practical because of the difficulty to accurately discern hazardous from non-hazardous items, based solely on underwater visual observations. The perimeters of the waste piles were delineated and the observed thickness of debris within each pile was recorded. Specific locations of electrical debris were recorded using differential global-positioning system (GPS) equipment and a hand-held rangefinder (see Figure 3).

The survey also extended downstream of the bounds of the previous survey (see Figure 4), and ended at the Sandblast Building drain outfalls. This survey included an area that consisted of the submerged near shore area 50 feet off the shore. This was conducted to observe any additional debris. Upon completion of the survey it became apparent that the debris on the north side of the island was one continuous pile (hereinafter known as Pile #2). This pile had previously been described as 2 separate piles in the FSP. Planned samples within the piles will be discussed together as the east and west portions of Pile #2.

A third pile was discovered in the extended survey area conducted as part of the work described in this report. The location of this pile (hereinafter known as Pile #3) is shown in Figure 3.

### 3.4.2 Water Column and Collocated Sediment Sample Collection

To assess potential release of contaminants to the water column during future retrieval of the electrical items, sediments from the river sampling areas were manually disturbed by a diver to entrain particulates in the water column. Immediately after disturbing the sediments, a sample of the water and associated suspended sediment was collected using a peristaltic pump. A diver assisted in this process by positioning the intake end of the tubing in the disturbed area. The entrained water and sediment were placed into a laboratory-provided jar. The water was separated from the sediment at the analytical laboratory. The particulate and dissolved portions of the sample were analyzed separately for PCBs.

Additional sediment samples were collected directly from the riverbed at the water sample locations, to help correlate the sediment data obtained with the water samples (described above) with the actual PCB content of the in-place sediments at the sample locations.

A total of nine water column and nine sediment samples were collected on May 2 and 3, 2001. Samples included five primary, one duplicate, one matrix spike (MS), one matrix spike duplicate (MSD) and one quality assurance sample. Of the five primary locations, three locations were

established within Pile #1, one location was established upstream of this pile to serve as a background location, and the remaining location was within Pile #2, near a lightning arrestor. The background location was on the shore of Goose Island, which is approximately 1,500 feet upstream of Bradford Island (Figure 2). Sample locations are shown in Figure 5. The sample locations within Pile #1 were located near previous sample locations, which indicate the presence of PCBs in these locations, to correlate those results with the existing data.

Samples were collected as described in the SAP. Sediment samples were characterized and logged by URS immediately after sampling. Copies of the field sampling data sheets are included in Appendix A.

### 3.4.3 Semi-Permeable Membrane Devices

The presence of PCBs in water can have biological consequences at concentrations below which it is possible to detect the contaminants in samples obtained using conventional sampling techniques. SPMDs can reveal occurrence of contamination at these environmentally-relevant levels (USGS, 1999). SPMDs are designed to mimic animal lipids; hydrophobic contaminants dissolve in the SPMD as they do in the lipid tissues of a fish. SPMD samples were collected to simulate passive diffusion of contaminants from wastes into the water column that would be available to accumulate in animal tissues.

The SPMD technology was developed by the U.S. Geological Survey (USGS) at the Columbia Environmental Research Center (Huckins et al, 1999). The SPMD consists of a membrane that is constructed from low-density polyethylene (LDPE). LDPE is essentially nonporous, although there are molecular-scale openings of approximately 10 angstrom (Å). After passing through these openings, the contaminants are sequestered onto a lipid film on the LDPE. After retrieval, the SPMDs are sent to the laboratory for analysis.

The standard SPMD configuration developed by the USGS were used (Huckins et al, 1999). The standard SPMD configuration (commercially available) consists of the following:

*Membrane:* LDPE layflat tubing manufactured without additives

*Sequestration Phase:* High-purity (95 percent) synthetic triolein

*Dimensions:* Generally 2.5-cm wide (layflat) by 91.4-cm-long LDPE tubes (75-95 micron wall thickness and surface area of approximately 450 square centimeters) containing 1 milliliter (0.915 gram) of triolein as a thin film. Other lengths and widths can also be used if the lipid-to-membrane mass ratio is approximately 0.2 and the membrane thickness is about the same.

Installation of the SPMD anchors was conducted according to the protocol specified in the SAP with the following exception: while three anchors were installed at the eastern portion of Pile #2 (which, as discussed, was previously thought to be a separate pile) as planned, one buoy line was caught in the boat prop rendering the anchor system unusable for SPMD installation. The remaining two anchor systems were installed to encompass upstream and downstream locations. Four of the anchor locations were selected for deploying SPMDs. One SPMD was placed

downstream (west) of Pile #1 and 2. The third SPMD was placed to the north of Pile #2. The fourth SPMD was deployed in the background location. Sample locations are presented in Figure 5.

The SPMDs were installed after samples were collected in order to allow a more accurate assessment of the steady state conditions.

LDPE strips of greater surface area without lipid were also collocated at selected SPMD anchor locations for reference samples. The analytical results of the LDPE strips alone will be considered for reference but will not be used to quantify PCB concentrations.

The SPMDs were deployed for 47 days. Originally, the SPMDs were to be removed after 15 days. The SPMD installation time was longer than intended because boats were not permitted in the area due to the Bonneville Power Administration's (BPA) unexpected decision to open the dam spillway to facilitate downstream fish passage on May 17, 2001.

It was necessary to retrieve the SPMDs by pulling up the entire anchor system rather than with the use of the pulley system because the SPMD anchor systems had become entangled in underwater debris during the period of deployment.

A total of nine SPMDs were analyzed by Battelle Pacific Northwest Laboratory in Sequim, Washington: four primary, one field duplicate, one equipment blank, one blank spike, one blank spike duplicate. The SPMDs were placed in an organic solvent to produce a dialysate. The SPMD dialysate was sent from Battelle to the USACE QA Laboratory for analysis as a quality assurance sample.

Analysis of the SPMD dialysate returns a concentration per gram of SPMD. The river water concentration was calculated using the theoretical relationship between the concentration of the compound *i* (Aroclor 1254 for this investigation) in water and in an SPMD during linear uptake and at equilibrium:

During linear uptake

$$C_{i,WATER} = \frac{C_{i,SPMD} \times V_{SPMD}}{R_i \times t}$$

At equilibrium

$$C_{i,SPMD} = C_{i,WATER} \times K_{i,SPMD} \times \left[ 1 - e^{\frac{-R_i \cdot t}{K_{i,SPMD} \cdot V_{SPMD}}} \right]$$

$C_{i,SPMD}$  = concentration of *i* in the SPMD in mass per volume of SPMD.

$C_{i,WATER}$  = constant concentration of *i* dissolved in water.

$K_{i,SPMD}$  = SPMD-water partition coefficient for *i*.  $K_{i,SPMD} = 0.3K_{ow}$ . The Log  $K_{ow}$  for Aroclor 1254 is estimated to be 6.98<sup>3</sup>, therefore the Log  $K_{i,SPMD}$  is estimated to be 6.5.

<sup>3</sup> The estimated  $K_{ow}$  was obtained from Environmental Science Center of Syracuse Research Corporation on-line database.

$R_i$  = SPMD sampling rate for  $i$ . Only sampling rates for congeners (not Aroclors) were available. Experimentally determined sampling rates for multiple congeners usually found in Aroclor 1254 were used in the model. Congeners 74, 84, 87, 91, 97, 99, 110, 118, 138, 128, 153 exhibited sampling rates ranging from 3.6 – 5.8 L/day<sup>4</sup>. The lowest, most conservative sampling rate of 3.6 L/day was used.

$t$  = duration of the SPMD exposure (47 days).

$V_{SPMD}$  = total volume of the SPMD (4.9 ml).

The SPMD sampling rate ( $R$ ) varies depending on environmental conditions such as SPMD biofouling, water temperature and water velocity. While these conditions were qualitatively assessed, the sampling rate was not adjusted to account for these environmental conditions because the nature of the dependence on these conditions cannot be accurately qualified. Because the environmental conditions are not accounted, the chemical concentrations calculated for the river water using SPMD data should be approximations. A study conducted in the Columbia River estimated the absolute error of the SPMD derived water concentrations not adjust for environmental concentrations to be less than an order of magnitude (USGS, 1999). In summary, while the absolute chemical concentrations should be considered approximations, the relative concentrations can be used with a higher degree of certainty. Finally, because environmental conditions at the various sampling locations were similar, data comparisons between these sampling locations can be made.

The length of time the SPMDs were exposed for uptake (47 days) has not been studied; it is not known whether the concentration of PCBs in the SPMDs was in the linear uptake phase, or had reached equilibrium at the time of collection. The most conservative model, the linear uptake equation, was used.

### 3.4.4 Sediment Sample Collection

Sediment samples were collected from Pile #1, Pile #2, and the background location. Samples were not collected from Pile #3. The samples were collected in different locations than the sediment collected for the water column samples. Half of the samples were analyzed for PCBs and TOC, while the other half were analyzed for the “full suite” of contaminants found at the upland landfill. The full analytical suite includes PCBs, petroleum hydrocarbons, total metals<sup>5</sup>, organochlorine pesticides, chlorinated herbicides, SVOCs, and TOC. In general, the COI list was used to establish the suite of analyses for sediment samples. VOCs were not analyzed for because they were not expected to be recoverable in the sediment samples due to their volatile nature.

<sup>4</sup> SPMD sampling rates are from in the USGS SPMD study of the Lower Columbia River (USGS, 1999).

<sup>5</sup> Aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium (total), cobalt, copper, iron, lead, manganese, magnesium, mercury, potassium, nickel, selenium, silver, thallium, tin, vanadium, and, zinc.

A total of twelve sediment samples were collected on May 2 and 3, 2001. Samples included eight primary, one duplicate, one MS, one MSD and one quality assurance sample. Due to the coarse nature of the riverbed, an attempt was made to collect representative samples of the fine-grained sediment from concentrated areas between the cobbles. Samples were collected as described in the SAP with the following exception. At the request of DEQ, sediment samples were collected in Pile #2 where electrical debris was found. The SAP stated that sediment would not be collected if electrical debris were found. Sample locations are depicted in Figure 5. Sediment samples were characterized and logged by URS immediately after sampling. Copies of the field sampling data sheets are included in Appendix A.

### 3.4.5 Biological Tissue Collection

Aquatic invertebrate samples were collected and analyzed to assess whether there had been any uptake of PCBs by near-shore aquatic species. The species studied were crayfish (*Pacifastacus* sp.) and clams (*Corbicula fluminea*). These two invertebrates were not chosen based on a characterization of the benthic community, rather they were chosen because they have been observed during previous in-water surveys adjacent to the Bradford Island Landfill.

Eight clam samples were collected between April 30 and May 3, 2001: four primary, one duplicate, one MS, one MSD and one quality assurance sample. Eight crayfish samples were collected May 9 and June 19, 2001 (see below for explanation of the sampling dates): four primary, one duplicate, one MS, one MSD and one quality assurance sample. Samples of each invertebrate were collected from Pile #1, Pile #2, and from the upstream sampling location. Clam tissue sample locations are depicted in Figure 5 and sampling sheets indicating average clam sizes are included in Appendix A.

The crayfish were collected using traps, which were deployed for approximately two weeks. The bait used in the crayfish traps (canned tuna and salmon) was analyzed for PCBs prior to use. No PCBs were detected in the crawfish bait. Crayfish were collected on May 9, 2001 and then again on June 19, 2001. Sufficient numbers of crayfish were collected to submit samples from each of the four sampling locations, one field duplicate, one MS one MSD and one quality assurance sample. Approximate crayfish sample locations are depicted in Figure 5 and the number of crayfish collected and their sizes are presented in Table 3-2. Sampling sheets are included in Appendix A.

Although an attempt was made to select from all locations similarly-sized individuals for analysis, the average size of crayfish collected at the background location were much larger than crayfish collected at the debris piles. In addition, the average crayfish size at Pile #1 was smaller than at Pile #2. As a result, the tissue concentrations may not be directly comparable.

The tissue samples were prepared and analyzed by Battelle. The entire crayfish was blended and extracted for analysis. The clams were positively identified as *Corbicula* and were shucked before extraction and analysis.

### 3.4.6 Stormwater Drain Evaluation

The purpose of the stormwater drain evaluation was twofold: 1) to assess whether the historic PCB release near the Sandblast Building or other activities or discharges captured by upland storm drain system has impacted the near-shore sediments, and 2) to evaluate if residual contamination was present in the catch basins of the stormwater system.

Before sampling was conducted, the drainlines were located using standard utility locating techniques. The locations of the buried pipelines and the areas they drain were delineated and are presented in Figure 4.

A total of eight samples were collected from the catch basins and two outfalls. Four primary, one duplicate, one MS, one MSD and one quality assurance sample were collected. Sediment samples collected from the catch basin area were analyzed for PCBs, SVOCs, VOCs, metals, hydrocarbons, TOC and butyltins. Sediment samples collected from the two outfall areas were analyzed for PCBs, SVOCs, metals, hydrocarbons, TOC, total butyltins, and butyltins in pore water. Sample collection was conducted in the manner described in the SAP with the following exceptions. At drain catch basin # 2 the sediment volume was insufficient for analysis. A sample was collected from the area directly above the catch basin where the runoff appears to pool prior to entering the catch basin. Directly below both drain outfalls on the shoreline of the island, sediment volume was insufficient for analysis, this area is covered by riprap. Therefore, sediment samples were collected from the river bottom by a diver directly offshore from the outfalls. Sample locations are depicted in Figure 4.

### 3.4.7 Waste Management

Sample results of the debris removed during previous dives were reviewed to characterize the waste for disposal. The contents of the drums of IDW generated from past investigations and removal activities were also reviewed to identify the disposal options. Characterization and disposal-related activity is detailed in the technical memorandum in Appendix F.



## 4.0 INVESTIGATION RESULTS

### 4.1 COMPREHENSIVE SURVEY

Debris pile delineation and electrical debris locations for the three piles as identified during this and previous in-water surveys are depicted in Figure 3.

The debris piles are described below in order of location from east to west. Volume estimates were made of total debris and electrical debris. Electrical debris includes lightening arrestors, interteer capacitors, light ballasts, switches, post insulators and other miscellaneous electrical equipment.

**Pile #1** - The dimensions of the debris pile are approximately 75 by 63 feet. This was calculated by plotting the individual items observed during the survey and drawing a line around the extent of the items. The diver reported the debris to be about one foot deep in most locations and two feet deep in isolated pockets. The volume of the debris pile was estimated using a depth of one foot (using a depth of two feet would grossly overestimate the volume) and resulted in an estimated debris volume of 4,725 cubic feet. The percentage of debris estimated to be electrical debris is 70%, resulting in a conservative electrical debris volume estimate of 3,308 cubic feet (123 cubic yards).

Debris was also observed along the shoreline of the island in this area. The debris consisted of wire cable; no electrical debris was noted along the shore. The presence of the debris corresponds to the information gathered from interviews of past USACE employees which indicated that switchgear and various cables were dumped in this vicinity (Tetra Tech, 1998).

**Area between Pile #1 and Pile #2** - This area was observed to contain very little debris: cable or wire, a piece of culvert, cyclone fencing, and an electrical control panel were observed. The volume of electrical debris is conservatively estimated to be approximately 10 cubic feet. This debris in this area was determined to be an extension of Pile #2, rather than a detached, separate pile.

**Pile #2** - The dimensions of the debris pile are approximately 88 by 38 feet. The diver reported the debris to be about one foot deep on the west end of the pile, and 2-3 feet deep near the eastern end of the pile. The volume of debris in Pile #2 is estimated conservatively to be 6,688 cubic feet based on a thickness of two feet. The debris was estimated to be 50% electrical, resulting in a conservative electrical debris volume estimate of 3,344 cubic feet (124 cubic yards).

**Pile #3** - This pile was discovered during the May 2001 downstream survey; the area had not previously been surveyed. The dimensions of the debris pile are approximately 40 by 30 feet and 1-2 feet deep. The debris consists almost entirely of lightning arrestors. The volume of electrical debris in this pile is conservatively estimated to be 1,800 cubic feet (66 cubic yards). This pile is depicted in Figure 3.

Approximately 8,462 cubic feet (313 cubic yards) of electrical debris has been identified (all debris piles) in the Columbia River near the Bradford Island shoreline proximate to the landfill.

#### 4.1.1 Discussion of Survey Results

Electrical equipment found near the shore of Bradford Island is the primary source of PCBs. The concentration of PCBs varies with the type of equipment. Equipment may contain PCBs as dielectric fluid in a liquid or solid phase. Four types of equipment previously recovered from the river have been shown to contain PCBs (see table below). Inerteen was a dielectric (insulating) fluid used by Westinghouse Electric Corporation in capacitors. As originally formulated, Inerteen contained a mixture of between 60 – 75% PCBs and 25 – 40% trichlorobenzenes, depending on the specific mixture.

Equipment Type	Concentration of PCBs	Solid or Liquid
Inerteen Capacitor	20 percent	Liquid
Coupling Capacitor	1.99 mg/kg	Liquid
Lighting Ballast	258 mg/kg	Solid
Lightening Arrestor (felt)	6.35 mg/kg	Solid

One of the capacitors retrieved during the December 2000 (partial) equipment removal generated a oily sheen when placed into a containment drum for storage. To the extent this item is representative of other items still in the river, PCBs from other electrical equipment may also be being released. There remains some uncertainty with respect to the contents of the debris piles. The noted contents are restricted to those at the surface of the piles visible to the diver.

#### 4.2 WATER COLUMN AND COLLOCATED SEDIMENT RESULTS

Laboratory analytical results for water column samples are summarized in Table 4-1 and include the sediment, particulate and dissolved phase (water) concentrations. The water column samples were filter at the laboratory through a 0.7-micron glass filter to separate the phases.

At the request of the Oregon Department of Environmental Quality (DEQ), sediment PCB concentrations were compared to the National Oceanic and Atmospheric Administration Freshwater Sediment Ecological Threshold Effects Level (NOAA TEL) (Buchman, 1999) and to the background sample result collected upstream at Goose Island. Water PCB concentrations were evaluated against the Ambient Water Quality Criteria (AWQC) (USEPA, 1999). A summary and description of these benchmark-screening values is presented in Table 4-18.



#### 4.2.1 Sediment

Aroclor 1254 was detected in the sediment samples collected at the same locations as the water column samples at Piles #1 and #2 and exceeded the NOAA TEL (0.0341 mg/kg) in each case. Aroclor 1254 was detected in the background sample at a concentration of 0.0178 mg/kg. The background sample did not exceed the NOAA TEL.

#### 4.2.2 Particulate

Particulate analytical results were reported in terms of the mass ( $\mu\text{g}$ ) of PCBs in the volume of water that was filtered (liter) to collect particulates for analysis. Pile sample results ranged from 7.28  $\mu\text{g/L}$  to 0.132  $\mu\text{g/L}$  in Pile #1 and was reported to be 0.243  $\mu\text{g/L}$  in Pile #2. PCB concentrations were higher in the water column within Pile #1 than Pile #2 for both dissolved and particulate phase (Aroclor 1254 only). Aroclor 1254 was detected in both Piles #1 and #2 water column particulate samples and exceeded the AWQC (0.014  $\mu\text{g/L}$ ). PCBs were not detected at the background location in the particulate phase, due possibly to the lower sediment concentrations when compared to the concentrations of PCBs within the piles.

#### 4.2.3 Dissolved

Aroclor 1254 was found both Piles #1 and #2 water column dissolved samples and exceeded the AWQC. A field duplicate result within Pile #1 exhibited a dissolved PCB concentration of 0.0399  $\mu\text{g/L}$ , a concentration also above the AWQC. However, PCBs were not detected in the primary sample, associated with this field duplicate. PCBs were not detected at the background location in the dissolved phase. Pile sample results ranged from 0.265  $\mu\text{g/L}$  to 0.0174  $\mu\text{g/L}$  in Pile #1 and were reported to be 0.0199  $\mu\text{g/L}$  in Pile #2.

#### 4.2.4 Discussion of Water Column Results

The water column sample technique was designed to mimic the affects of the proposed equipment removal on water quality. Samples of both the water and the particulate was collected and analyzed, yielding data of the PCB content of both the suspended solids (particulate) and dissolved fraction of the water column sample. PCBs were present in the water column in both the particulate and dissolved phases. Concentrations of PCBs in the water column tended to correspond in magnitude to concentrations of PCBs in the sediment. Therefore, it is concluded that a localized increase in turbidity would result in a localized increase in partitioning of PCB from the particulate (resuspended sediment) component to the river water (dissolved component).

The USEPA Ambient Water Quality Criteria for PCBs (total PCBs) in freshwater are 2.0  $\mu\text{g/L}$  for Criterion Maximum Exposure (CMC) and 0.014  $\mu\text{g/L}$  for the Criterion Continuous Exposure (CCC) for the protection of aquatic biota. The CMC represents a conservative acceptable concentration in water for acute exposures (typically derived from 48-hour and 96-hour toxicity tests) and the CCC is protective of chronic exposures (typically derived from tests longer than 96

hours). For PCBs, the CCC value also takes into account the potential for bioaccumulation. These criteria are based on a default assumption of 5 mg/L dissolved organic carbon (DOC) or less. These criteria have been adopted by Oregon as their PCB water quality standards for protection of aquatic life.

The likely average concentrations of PCBs in water exceed the CCC values but are lower than the CMC value. If DOC in the water column exceeds 5 mg/L, the application of the AWQC would increase in conservatism, due to reduced bioavailability of PCB in the water column. The AWQC also have uncertainty factors built into their development to provide for additional margins of safety and therefore represent theoretical "no effects" levels. Exceedance of the AWQC therefore does not mean that adverse effects are probable or likely, only that the intentionally conservative threshold level has been exceeded.

Due to the fact that a dissolved sample was not collected under ambient conditions, it can not be definitively determined that the presence of PCBs in the dissolved sample is a result of the sediment disturbance (i.e. PCBs may be present during ambient conditions). However, SPMD concentrations indicate that Aroclor 1254 is not present in the water column at the debris piles or at the background location at ambient conditions.

### 4.3 SEDIMENT RESULTS

All nine sediment samples were analyzed for PCBs and TOC. Five of the samples were also analyzed for pesticides, SVOCs, herbicides, metals and hydrocarbons. Three samples were analyzed for grain-size distribution (one from Pile #1 and two from Pile #2). Laboratory analytical results for sediment samples are summarized in Tables 4-2 through 4-7. At the request of DEQ, sediment results were compared to the following conservative ecological screening values in order of priority:

- NOAA TEL (Buchman, 1999)
- Threshold Effect Concentrations (TEC) (MacDonald *et al*, 2000).

In the event a NOAA TEL or TEC value was not available for a particular compound, the lowest of the following screening values was selected for comparison to sediment results:

- Canadian Sediment Quality Guidelines for the Protection of Aquatic Life-Interim Freshwater Sediment Quality Guidelines (ISQGs) (Canadian Council of Ministers of the Environment, 1999)
- Ontario Ministry of the Environment Lowest Effect Level [Ontario LEL] (Ontario Ministry of the Environment, 1993)
- Assessment and Remediation of Contaminated Sediment Project Threshold Effect Concentration [ARCS] (USEPA, 1996)
- Oak Ridge National Laboratory Secondary Chronic Values [ORNL] (Jones, 1997)
- Office of Solid Waste and Emergency Response [OSWER] (USEPA, 1996)

- Environmental Protection Agency Region 9 [Region 9] (1995)
- Washington State Sediment Quality Criteria “No Effects” level (Washington State Department of Ecology, 1998)
- New York State Sediment Lowest Effect Level for Metals [New York LEL] (New York State Department of Environmental Conservation, 1999)

The screening values used in the evaluation of each compound are provided in the Analytical Results Tables. A summary and description of all benchmark-screening values is presented in Table 4-18. Compounds for which no screening values were available are presented in Table 4-19. Method reporting limits for six compounds were above benchmark values. However, it is possible to confirm the absence of the contaminants above the benchmark values because the detection limits were below the benchmark values. Further discussion of the method reporting limits is available in the quality assurance/quality control (QA/QC) review (Appendix C).

#### 4.3.1 PCBs

Aroclor 1254 was detected in sediments within and on the perimeter of Piles #1 and #2; concentrations exceeded the NOAA TEL. PCBs were not detected at the perimeter sample collected from Pile #1. The results for sediment samples collected within Pile #2 are discussed in Section 4.2, Water Column Results. For both piles, PCB concentrations are highest in the interior and are much lower at the perimeter locations. For Pile #1, PCBs were not detected in the perimeter locations and for Pile #2, concentrations at the perimeter ranged from one-third to one-fifth of the interior concentrations. The PCB sample results are shown in Figure 6, as well as the tables noted above.

#### 4.3.2 Pesticides

The pesticides 4,4'-DDD, 4,4'-DDT and 4,4'-DDE were detected in the sediments on the perimeter of Pile #2, but did not exceed any of the benchmark screening values. No other pesticides were detected. Although the reporting limits for some of the pesticides exceeded the screening values, the RLs represent the limits of practically attainable analytical testing technology. However, the uniform absence of pesticide detections in all the samples suggests that there is little reason to believe these compounds are significant sediment contaminants. Therefore, the exceedance of SBVs by some of the pesticide RLs is unlikely to be a significant data gap or data deficiency.

#### 4.3.3 TOCs

TOC results in sediments for all debris piles were below 5,000 mg/kg (0.5%). The grain size distribution for sediment samples indicates that pile samples are composed almost entirely of gravel and sand with 2.5 % or less of silt and clay. The grain size, in combination with the low organic carbon content, indicates that the areas of the piles are not conducive to partitioning of PCB compounds into the solid (sediment) phase. The presence of PCBs in sediment may

represent an uncertainty with the TOC results or may indicate that another organic phase (i.e. oil) exists within the sediment.

#### **4.3.4 SVOCs**

SVOCs were detected in all of the debris piles. Several polycyclic aromatic hydrocarbons (PAHs) were detected above the NOAA TEL on the perimeter of Pile #2 including benzo(a)anthracene (59 µg/kg), benzo(a)pyrene (78 µg/kg), benzo(b)fluoranthene (87 µg/kg), chrysene (58 µg/kg), fluoranthene (98 µg/kg), indeno(1,2,3-cd)pyrene (29 µg/kg), phenol (35 µg/kg), pyrene (100 µg/kg). Benzidine was detected on the perimeter and within Pile #2 at concentrations exceeding the ORNL (1.7 µg/kg), the lowest of the freshwater sediment ecological benchmark screening values.

#### **4.3.5 Herbicides**

Herbicides were not detected in the sediment samples at the reported detection limits.

#### **4.3.6 Metals**

Cadmium, copper, lead and iron were detected above benchmark values (NOAA TEL, NOAA TEL, New York LEL and Ontario LEL, respectively) in the debris piles, however cadmium concentrations were similar to background concentrations (Lower Columbia River Bi-State Program, 1993). In addition, nickel was detected above the NOAA TEL benchmark on the perimeter of Pile #1 and manganese was detected above the Ontario and New York LEL benchmarks. For all the metals, the exceedances were relatively low, and less than two times the benchmark screening value.

#### **4.3.7 Hydrocarbons**

Hydrocarbons were not detected in the sediment samples at the reported detection limits.

#### **4.3.8 Grain Size**

Pile #1 contained a well-graded gravel-sand mixture with little or no fines (Unified Soil Classification System [USCS] classification GW). Pile #2 contained well-graded gravelly sands with little or no fines (USCS classification SW) (ASTM, 1993). These samples represent the pockets of sediment that exist in between the debris and larger (cobble size) grains. There may be some uncertainty with the results since the sampling method utilized (a diver placing sediment into a jar underwater) could result in an unknown loss of fines.

#### **4.3.9 Discussion of Sediment Results**

The source of the PCBs within the sediment appears to be the electrical equipment. The PCB Aroclor found in the offshore area of Bradford Island matches the Aroclor type (1254) detected in the inerteen capacitor, coupling capacitor, lightning ballast and the felt on the end of a fuse

extracted from the area and sampled for disposal. A different Aroclor, Aroclor 1260, was detected in the soil in the landfill (Tetra Tech, 1998) indicating that the source of PCB contamination in the water may not be the result of soil erosion or groundwater transport from Bradford Island. Aroclor 1260 was also detected in the drain and outfall samples near the Sandblast Building, and may be directly related to the PCB oil released from a transformer in 1995 (USACE, 1995).

While the equipment is the primary source of PCBs, the contaminated sediment represents a secondary source of PCBs. PCBs were detected in the sediment up to a concentration of 23.9 mg/kg. The PCB concentrations near existing or removed equipment are generally higher than sediment concentrations further away from the equipment, suggesting a concentration gradient decreasing away from the equipment. The offshore area is a high-energy environment or scour area based on the demonstrated high river velocities, which is evidenced by the general lack of fine-grained sediment that exists, and the fact that the relatively coarse-grained sediments at the site contain elevated PCB concentrations.

The elevated PCB concentrations in sediment at the site are unusual because the grain size of the sediment is coarse and the total organic carbon concentrations are low. Typically, PCBs released in aquatic environments are generally expected to sorb to organic carbon found in fine-grained sediments. Therefore, PCBs are generally found where fine-grained (carbon-rich) sediments exist. The elevated PCB concentrations at the site may be explained by the presence of trace amounts of the dielectric as liquid or solid phase in the sediments.

#### 4.4 SPMD RESULTS

Analytical results are presented in Table 4-9. SPMDs were reported as non-detect for PCB Aroclors.

The SPMD method-reporting limit for PCB Aroclor 1254 was reported by the laboratory in units of ng/SPMD. The reporting limit for Aroclor 1254 in the water was calculated using the method described in Section 3.4.3. As discussed in Section 3.4.3, calculated reporting limits should be considered estimates. When the more conservative linear uptake model is applied, the non-detect Aroclor 1254 concentration is 0.2 ng/L. The level at which the Aroclor was not detected is below the AWQC of 14 ng/L.

##### 4.4.1 Discussion of SPMD Results

The presence of PCBs in water can have biological consequences at concentrations below which it is possible to detect the contaminants in samples obtained using conventional sampling techniques. SPMDs can reveal occurrence of contamination at these environmentally-relevant levels (USGS, 1999). SPMD results indicate that PCB-Aroclors are not present at these low levels during steady-state conditions. While the water column results (dissolved and particulate) indicate that localized partitioning of PCBs to the water column may occur when sediments are mechanically suspended, the PCBs did not appear to partition to the water column during steady-state conditions.

## 4.5 BIOLOGICAL TISSUE RESULTS

Clam and crayfish tissue was analyzed for PCBs and lipid content. PCBs were detected in clam tissue and crayfish tissue and exoskeleton collected at the debris piles and at the background location.

Analytical results are presented in Table 4-10. Aroclor 1254 was detected in all clam tissue samples collected at the debris piles at concentrations ranging from 604  $\mu\text{g/kg}$  to 344  $\mu\text{g/kg}$ . Clam tissue collected at the background location exhibited an Aroclor 1254 concentration of 23.8  $\mu\text{g/kg}$ . In general, the debris pile clam tissue concentrations of Aroclor 1254 were ten times the concentration found in the clam tissue collected at the background location.

Crayfish sample results collected at the debris piles exhibited Aroclor 1254 concentrations ranging from 2,670  $\mu\text{g/kg}$  to 75,600  $\mu\text{g/kg}$ . Crayfish collected at the background location exhibited an Aroclor 1254 concentration of 268  $\mu\text{g/kg}$ . PCBs detected in crayfish may be the result of bioaccumulation or may be due to presence of PCBs (in dielectric fluid) on the crayfish skeleton, or a combination of both. If crayfish concentrations are a result of bioaccumulation, crayfish sample results may not be directly comparable due to the differences in the sizes of individuals between the sample locations. PCB concentrations will tend to be higher in larger, older crayfish due to the longer period of time the individuals are exposed. Crayfish weight and sizes are presented in Table 3-2.

The relatively high concentrations of Aroclor 1254 in the tissues for sediment-associated biota at the piles, the detection of the same Aroclor in the sediment, and the lack of Aroclor 1254 in the water column at steady state conditions (as sampled with the SPMDs), indicates that the sediment in the piles may be an exposure medium for ecological receptors. Similarly, these data suggest that the river water may not be a significant source of PCBs observed in the species studied.

### 4.5.1 Discussion of Tissue Results

There are no readily available screening benchmark values for PCBs in shellfish tissues. However, there are a variety of screening values for PCBs in fish tissues that have been developed for the protection of aquatic biota and humans who may consume fish. These benchmark values range from 10  $\mu\text{g/kg}$  to 23  $\mu\text{g/kg}$  (whole fish, wet wt) for the protection of human health and 100  $\mu\text{g/kg}$  for the protection of piscivorous wildlife (USEPA 1995, OEHHA 1998, GLWQI 1989). In the absence of shellfish-specific tissue screening values, the fish tissue screening values (for protection of aquatic biota and for human health) were compared against the reported clam and crayfish tissue concentrations. The screening values were exceeded for both clams and crayfish, at all locations including the background locations. However, the magnitude of exceedance was greater at the debris piles.

The exceedance of screening benchmark values (for water, sediment and tissues) does not necessarily indicate that there is actually a risk to ecological or human receptors who may be exposed to these media. The benchmark values are generic, non-site-specific, intentionally



conservative values that are meant to be used for screening purposes only. As such, detected chemicals that do not exceed their benchmark values may be eliminated from further risk considerations. Chemicals that exceed their benchmark values may be evaluated further, on a more site-specific and receptor-specific basis to assess whether they are present at concentrations that are likely to pose a threat to aquatic biota and associated wildlife and human receptors. This additional evaluation may be performed in accordance with DEQ's Guidance for Ecological Risk Assessment. Alternatively, since the exceedances of chemicals appear to be localized the option of removal of the localized elevated concentrations without further assessment may also be considered.

## 4.6 STORMWATER DRAIN SEDIMENT RESULTS

The stormwater catch basin and outfall sediment samples were analyzed for PCBs, TOC, SVOCs, metals, hydrocarbons and butyltins. In addition, the catch basin samples were analyzed for VOCs and the outfall samples were analyzed for butyltins in porewater. Analytical results are presented in tables 4-11 through 4-15. At the request of DEQ, sediment results were again compared to the NOAA TEL and TEC. In the event a NOAA TEL or TEC was not available for a particular compound, the lowest of the screening values provided in Section 4.3 was chosen for comparison to sediment results. The tributyltin results were compared to the Puget Sound Tributyltin No Adverse Effect Level (Puget Sound NEL). The screening values used in the evaluation of each compound are provided on the Analytical Results Tables. A summary and description of all benchmark values is presented in Table 4-18. Compounds for which no screening values were available are presented in Table 4-19.

### 4.6.1 PCBs

Aroclor 1260 was detected in all catch basin and outfall samples. The Aroclor 1260 concentration exceeded the NOAA TEL benchmark in catch basin #1 and drain outfall #1 (Figure 4).

### 4.6.2 TOCs

TOC concentrations were between 4,100 and 20,000 mg/kg (0.41 – 2%).

### 4.6.3 SVOCs

SVOCs were detected in all of the catch basin and outfall samples. Several PAHs were detected above the NOAA TEL in all of the samples. In addition, bis(2-ethylhexyl)phthalate concentrations in catch basin #1 and #2 and outfall sample #1 exceeded the Region 9 benchmark value.

### 4.6.4 VOCs

Acetone and carbon disulfide concentrations in both catch basin #1 and #2 exceeded the ORNL.

#### **4.6.5 Metals**

Arsenic, cadmium, chromium, copper, nickel and zinc concentrations exceeded NOAA TEL benchmark values in all samples. In addition, iron and manganese were detected above the NY and Ontario LEL benchmark values in all sample locations. Arsenic, cadmium, iron, manganese and some nickel concentrations were similar to background soil concentrations (Washington State Department of Ecology, 1994).

#### **4.6.6 Hydrocarbons**

Hydrocarbons in the diesel and motor oil range were detected in all catch basin and outfall samples. No ecological sediment screening benchmark value was available for hydrocarbons in the diesel or motor oil range.

#### **4.6.7 Butyltins**

Butyltins were detected in catch basin #1, drain outfall #1 and drain outfall #2 sediment samples. The catch basin #2 tributyltin (TBT) concentration exceeded the Puget Sound NEL saltwater benchmark value. Porewater analysis for butyltins exhibited detections for mono- and dibutyltin, however, no benchmark screening values were available for comparison. TBT was not detected in the porewater analyses.

#### **4.6.8 Discussion of Sediment Results**

Contaminants found in the catch basins near the Sandblast Building appear to have impacted the sediment collected directly below the catch basin outfalls in the Columbia River. The contamination consists of mostly the same PCB, PAH and metals compounds in the drain samples (Tables 4-11, 4-13 and 4-15). In addition, the PCB Aroclor found in the catch basins and the sediment below the outfalls in the sandblast grit area (Aroclor 1260) is the same Aroclor found in the transformer fluid spilled at this location in 1995. This differs from the sediments adjacent to the landfill, where Aroclor 1254 was detected.

TBT was detected above the selected benchmark value in the bulk sediment above catch basin #2. The bulk sediment TBT concentration collected below the catch basin #2 outfall was below the benchmark value. TBT was not detected in the pore water sampled below the outfall, indicating that the compound is not bio-available to potential aquatic ecological receptors.

The stormwater drains exhibit contamination that may be a result of maintenance activities conducted nearby and the sandblast building and the release of transformer oil.

### **4.7 WASTE CHARACTERIZATION**

To facilitate waste disposal, USACE sampled electrical equipment retrieved from the shoreline of Bradford Island in October 2000. Analytical results are summarized in Table 4-20. PCB



Aroclor 1254 was detected in four pieces of electrical equipment. The results of the USACE's electrical equipment testing are presented in Appendix F.

#### **4.8 DATA QUALITY EVALUATION**

Laboratory data was independently validated for quality and usability. The validation identified false positives (PAHs), unverifiable quantitation limits, and results that should be considered estimated. The Data Validation Report is presented in Appendix C.

Validated concentrations, quantitation limits and qualifiers are presented in the Analytical Data Summary tables (Tables 4-1 through 4-17). The data is acceptable for project use as reported with associated qualifiers.

#### **4.9 UNCERTAINTIES IN FIELD AND ANALYTICAL DATA**

The data evaluation process includes several sources of uncertainty. There are uncertainties associated with field sampling and collection and laboratory analyses that introduce some unavoidable and unquantifiable uncertainty into the data that may tend to underestimate or overestimate actual contaminant concentrations. Additionally, for some pesticide chemicals, the RLs exceeded the screening benchmark values. Because these were a limited number of chemicals and they were uniformly reported as non-detects, it is believed that their occurrence is unlikely and therefore, the uncertainty associated with the high RLs is believed to be of low significance for this site investigation.

There are also a number of chemicals for which no screening benchmarks were available (Table 4-19) including several inorganics (metals), SVOCs and herbicides. The majority of these chemicals were reported as non-detects. The few chemicals that were detected are primarily metals with a generally low or poorly known potential for ecological toxicity (selenium excluded). The primary source of these chemicals, if they were likely to occur, would be through overland runoff from the landfill via stormwater.

The type of Aroclor that was found in the in-water surveys (Aroclor 1254) is different from the Aroclor 1260 that was found at the landfill, indicating that solid phase transport from the landfill does not appear to be a significant source of PCBs (and by extension, other low solubility chemicals) to the river sediments. Because of the low potential for these chemicals without benchmarks to be actually present in the sediments, the uncertainty associated with these analytical data is believed to be of low significance.

## 5.0 SUMMARY AND CONCLUSIONS

### 5.1 STORMWATER DRAIN SUMMARY

Sediments from both of the catch basins and near the outfalls in the river exhibited PCB Aroclor 1260 concentrations; catch basin and outfall #1 exhibited concentrations above the selected benchmark screening value for PCBs. Several PAHs and metals were present above screening values in all locations. Acetone and carbon disulfide were detected at concentrations above selected benchmark values in both catch basins and TBT was detected above the selected benchmark value at catch basin #2. It appears that maintenance activities conducted near the catch basins have impacted the sediment within the catch basins and that sediment has been transported into the river.

### 5.2 IN-WATER PILES SUMMARY

Three debris piles containing electrical equipment were found and delineated in the offshore area of Bradford Island. The approximate extent and volume (313 cubic yards) of electrical debris in the water has been delineated. The number and locations of debris piles are similar to the areas described and drawn by employees interviewed during the Final Site Investigation (Tetra Tech, 1998). No further debris associated with the landfill is expected in the offshore area proximate to the Bradford Island Landfill.

Investigation of the sediment in the debris piles resulted in partial delineation of the extent of contamination. PCBs in sediments within Pile #1 area was limited to samples taken within the debris pile, while PCBs in sediments within Pile #2 area was detected within and on the perimeter of this pile. Sediments proximate to the debris pile discovered during this investigation (Pile #3) have not yet been evaluated. Besides PCBs, other chemicals found in sediment that exhibited concentrations above screening values include selected metals in Pile #1 and Pile #2, and PAHs in Pile #2.

Water column sediment and particulate concentrations and clam and crayfish tissue results exhibit PCB concentrations above background results. Dissolved PCBs in the water column were detected in Pile #1 in two locations above the AWQC in samples collected while sediment was suspended. PCB Aroclors were not detected in the water column in SPMD samples taken during steady state conditions.

If sediments are suspended, temporary and localized release of contaminants may occur, making them available to aquatic biota. However, this limited exposure is not expected to cause adverse effects to aquatic biota through the mechanism of toxicity due to direct exposure or due to food web-mediated exposure.

Benthic invertebrates are exposed to PCBs via contaminated sediments. Sediment contamination and the resulting ecological risk is not expected to increase as a result of removal of equipment from the site. Instead, the magnitude of risk will be reduced by the removal of the continuing source of PCBs represented by the electrical equipment.

### 5.3 CONCEPTUAL SITE MODEL

The conceptual model based on the results of the in-water investigation is summarized as follows:

- a) Some of the PCB-containing electrical equipment disposed of into the Columbia River have leaked, and continue to leak, releasing PCBs into the water and sediment surrounding the waste disposal area.
- b) Little contaminated sediment is present in the disposal area, due to annual scouring (i.e., suspended and bedload transport of sediment) of the region when the dam spillway is open (generally during Spring runoff). Therefore, the detection of PCB contaminated sediment suggests in this area suggests a continuing source of PCBs to the environment.
- c) PCBs have impacted (through direct contact or accumulation of PCBs) benthic aquatic species in the disposal area.
- d) Due to the small volume of PCB equipment present, and the apparent low rate of release due to equipment leakage, only very low PCB concentrations are present in the water column (as dissolved component PCBs) under normal river conditions (below detection, based on SPMD data from the in-water investigation).
- e) Elevated PCBs will be present in the water column (as dissolved and particulate components) during the proposed electrical equipment removal (as well as during the anticipated Spring spill after the fish window), due to the release of PCBs from affected sediments that become entrained in the water column during the work (based on the water column data from the in-water investigation).

## **6.0 EQUIPMENT REMOVAL EVALUATION**

### **6.1 JUSTIFICATION**

One of the primary objectives of this investigation was to determine whether the PCB containing items should be removed, when they should be removed and what types of “best engineering practices” could be employed to minimize the risks to the environment. The conceptual site model developed from this data indicates that the electrical items are a continuing source of PCBs in the environment. This has lead to the conclusion that leaving the equipment in the river poses a greater threat to the environment than removing them and also to the determination that the items should be removed as soon as possible. The following sections describe a removal plan that is based on earlier work as well as on this data and develop a preliminary ecological risk screening for the removal action.

### **6.2 CONCEPTUAL REMOVAL PLAN**

Several removal options were considered for removal of the electrical equipment, including an isolation cofferdam and excavation; mechanical dredging; and a diver-assisted removal. The proposed removal plan is a diver-assisted equipment removal. This method is preferred for the following reasons:

- Timing - it can be conducted within the current fish window.
- Proven effectiveness – the same approach worked well in December 2000.
- Size of the project – the volume of waste (313 cubic yards) is relatively small and a good portion of the waste is non-PCB containing, therefore a simple and straightforward approach is warranted.
- Minimal adverse environmental risk – short-term increased exposure; little impacted sediment is present to entrain into the water column.
- Implementability– other techniques would require detailed designs, more equipment, and more time to perform.

The waste-related items will be removed from the three distinct near-shore areas identified during the investigation. Additional electrical components located within these three general areas, and any other components discovered, will be located and recovered. A diver will attach a recovery line to each item and a crane mounted on a barge will raise the items to the surface. Once at the surface, each item will be placed into a containment area on the barge.

During the recovery operation, a full depth turbidity screen will be installed and anchored in-place around the work area and will remain in place following recovery to allow for settling of suspended sediments. The screen type will likely consist of a nonwoven permeable fabric and be ballasted to maintain contact with the river bottom. A recent pilot study completed by URS at a former U.S. Steel facility (Shearwater site) in San Francisco Bay, California indicated that these

fabrics greatly reduce turbidity from dredging outside the protective screen. In one case the turbidity inside the screen was greater than 350 NTU while the turbidity outside the screen was just above background (12 NTU). Since the majority of the PCBs are associated with the particulate component (i.e. turbidity), containment of the turbid water minimizes exposure and risk. For this project, the turbidity screen will remain in-place following removal activities until the sediment entrained in the water column during operations settles as indicated by turbidity monitoring data.

Real-time turbidity monitoring will be implemented before, during and after equipment removal at regularly scheduled intervals, and at stations upstream and downstream at the river surface, at multiple depths. Visual observations for surface sheen or plumes will also be conducted. Action levels will be developed prior to implementation, and removal activities will be stopped if monitoring indicates an exceedance.

### 6.3 PRELIMINARY ECOLOGICAL RISK SCREENING

#### 6.3.1 Expected Concentrations and Toxicity

Adverse effects to biota during the removal process may occur in two ways: direct toxicity to benthic and aquatic invertebrates and fish that may be exposed to residual PCBs in the sediments and water column and bioaccumulation-related impacts to other biota that may consume these invertebrates. The transport mechanisms for PCBs during the removal would be: resuspension of the sediment particulates into the water column; partitioning from the particulate component to the dissolved component; further partitioning from the dissolved component to dissolved organic carbon (DOC) present in the water column; and transport of these components by river currents.

Detected PCBs in the dissolved phase were quantified as Aroclor 1254 during the diver-assisted resuspension study. The maximum measured concentration was 0.265 µg/L. The average concentration from all samples (excluding the Goose Island sample and applying one-half the detection limit for the one ND observation) was 0.069 µg/L. The average value is more representative of the potential concentrations in water during removal operations since it integrates the characteristics of all the debris piles. The particulate phase concentration was measured at a maximum of 7.28 µg/L and an average of 1.66 µg/L.

These measured concentrations in water are likely to overestimate the bioavailable concentration for aquatic biota for several reasons:

- 1) For molecules of large size such as more heavily chlorinated PCB congeners, molecular volume, lipid solubility and steric hindrance are all-important aspects, which regulate and limit the bioavailability of PCBs and their ability to pass through biological membranes. The ability of the less heavily chlorinated PCBs to bioaccumulate is reduced by sorption of less heavily chlorinated PCB congeners with dissolved organic carbon in water. DOC was not measured during the in-water investigation; its potential to reduce the bioavailability of PCBs is therefore unknown.

- 2) The highest PCB concentration would occur near the equipment being removed, and if a turbidity screen were placed around the area it would occur within the work area and would include both the soluble and the particulate-associated fractions. PCB concentrations outside the work area would be initially limited to the soluble phase. Dissolved concentrations would eventually be reduced due to the effects of adsorption onto particulate matter in the water column, and to the effects of mixing and dilution.
- 3) The dissolved phase PCB concentration will decrease as the concentrations are diluted in the river. Using the experimentally determined average dissolved water concentrations of 0.069 µg/L and a simple dilution calculation, the dissolved water concentration is estimated to be below the AWQC CCC (see Section 4.2 for additional discussion about the use of the benchmarks) within approximately 100 feet of the work area. In addition, it is expected that a portion of the dissolved PCBs may become sorbed to the turbidity screen fabric, thereby helping to lower the concentration of dissolved PCBs in the water column outside of the screen.
- 4) The exposure duration for elevated concentrations of PCBs in the water column is temporary and of limited duration (approximately 2 weeks). Therefore, the potential for increased exposure to aquatic receptors is also short-term and limited.

As stated above, concentrations of PCBs in water outside the work area are expected to be substantially lower than inside the work area. It is, in fact, likely that PCB concentrations in water outside the turbidity screen may be below detection limits. The potential exposure duration for aquatic invertebrates and fish is also likely to be more transitory due to their freedom of mobility outside the work area. As noted above, the potential average and maximum water soluble PCB levels within the work area are well below the LOEC values for invertebrates and fish. This is also true outside the work area where the PCB concentrations would be lower. Because of the expected decrease in PCB concentrations outside the work area, it is unlikely that the AWQC will be exceeded outside the work area. Furthermore the dissolved phase concentration would be diluted (see above). Therefore, toxicity to aquatic invertebrates and fish outside the work area due to increased PCB concentrations in the water column during removal is highly unlikely and not expected to occur.

A search of USEPA's aquatic toxicity database (AQUIRE) was conducted to identify more definitive sources of information for No Effects Concentrations (NOEC) and Lowest Observed Effects concentrations (LOEC) for test species that would be relevant to the project site. The lowest LOEC reported for a sub-lethal endpoint in freshwater invertebrates was the EC50 (50<sup>th</sup> percentile effects concentration) for reproductive effects seen in the water flea (*Daphnia magna*) at 1.1 µg/L for a 14-day exposure to Aroclor 1254 (Nebeke, 1974). Among freshwater fish, effects on growth were seen in the Coho salmon (*Onchorhynchus kisutch*) at 7.8 µg/L following a 14-day exposure period (Halter, 1974). The conservatively estimated soluble concentrations of PCBs (both maximum and average) within the recommended removal action work area are well below these LOEC levels. Therefore, the temporary and spatially limited exposure of aquatic biota within the work area to PCBs that may be solubilized during the removal are not expected



to cause adverse effects to aquatic biota through the mechanism of toxicity due to direct exposure.

### 6.3.2 Indirect Exposure and Bioaccumulation-Related Toxicity

Bioaccumulation is the process by which chemicals accumulate in biological tissues at concentrations that are higher than in the surrounding environment. Biomagnification is the process by which chemical concentrations in biota increase with increasing (e.g. higher) trophic status of the biota. PCBs, by virtue of their hydrophobic and lipophilic nature and persistence, bioaccumulate in the fatty tissue of biological organisms. PCBs are also one of the few chemicals documented to biomagnify in aquatic food webs. PCB levels in tissue generally increase with age, size and lipid content of the biota. Estimating (as opposed to measuring) the concentration of PCBs in tissues implies a certain steady state equilibrium between the abiotic and biotic media. The PCB equipment removal is proposed during an environmental window when anadromous fish and fish of high ecological or recreational value would be absent. Therefore, the potential for increased human health risks for anglers due to in water removal activity is low or absent.

The only fish that may be present and exposed to PCBs in water during removal activities would be resident fish. It is difficult to estimate the potential incremental increase in invertebrate or fish tissue concentrations of PCBs due to increased water column concentrations of PCBs for a period of 2 weeks and the subsequent increased risk to predators that may consume them. Aquatic biota that may accumulate increased PCBs during this period would most likely be confined within the work area and may or may not survive the effects of increased turbidity or other physical habitat disruption during equipment removal activities. Even if they survive the work period and escape into the free water column, it is unlikely that these fish would comprise the only food source for any piscivorous receptor such as cormorants, bald eagles or river otters (all of which may occur in the area).

Aquatic biota outside the work area will be exposed to lower dissolved PCB concentration, therefore they will likely bioaccumulate PCBs to a lesser degree. The SPMD data indicated no detectable concentrations of PCBs in the water column over a period of 47 days. Therefore, bioaccumulation in fish tissues due to dissolved PCBs in water is expected to be low or below detection. As a preliminary screening level comparison, the potential increase in fish tissue concentrations of PCBs was estimated by assuming 14 days of exposure for a resident fish (either white sturgeon and walleye which are both sought after game fish) in the area that has an average life span of 3 years. By applying USEPA's bioconcentration factor for PCBs in fish (31,200) given in the 1980 ambient water quality criterion document for PCB to the average measured soluble PCB concentration (0.069 µg/L), the concentration increase in fish due to remedial activity was estimated as 27 µg/kg (whole body). This is in addition to the PCB concentration already in fish resident in the vicinity of Bradford Island. The increased risk to the fish itself, and any wildlife consumers of fish from a 27 µg/kg increase in tissue residues would be an incremental risk above any risk already present from the existing body burdens of PCB. The estimated 27 µg/kg increase in PCB concentrations may in itself overestimate the increase in

PCB tissue residues due to a temporary increase in waterborne PCB concentrations. This is because the time for waterborne PCB to reach steady state normally exceeds 14 days in fish. The estimated site related PCB increase in fish tissues due to equipment removal is well below the Great Lakes screening value of 100 µg/kg in fish tissue for the protection of aquatic wildlife, including birds, mammals and carnivorous fish. Therefore, it is unlikely that there could be any increased risks to human or ecological receptors due to food web-mediated exposure to PCBs as a result of the in-water removal activities.

### 6.3.3 Toxicity to Benthic Invertebrates

Since this is an ongoing source and risk, the magnitude of this risk is not expected to increase due to the removal of electrical equipment. Rather, the risks would be ultimately be reduced, although not eliminated, by the removal of the continuing source of PCBs represented by the electrical equipment.

Residual concentrations in sediments are likely to exceed commonly used screening values for PCBs in sediments in the immediate area of the debris piles. However, this represents no change from current conditions. The elevated concentrations of PCBs measured in the crayfish and clams from within the debris piles would be expected to remain the same or decrease after removal of the piles and the continuing source of PCBs that they represent. Therefore, exposure of benthic biota to residual PCBs in the sediment would be no greater, and eventually lower than under current conditions. It is also unlikely that there would be any increase in exposure or dose for receptors that may feed on these benthic biota (e.g., diving birds). As seen in the videotape from the in-water investigation, shellfish and crayfish are distributed in large areas of the riverbed and were present in areas both inside and outside the debris piles. The proposed work area is small compared to the home range of mammalian and avian consumers of benthic species (although it is large compared to the home range of benthic species with limited or no mobility). Therefore, uncovering of sediments and associated benthos by removal of the electrical equipment would not represent a significant new food source for bottom feeders and divers and is not likely to lead to significantly increased risk for these receptors.

### 6.3.4 Potential Adverse Effects

The potential adverse effects associated with PCBs during the in-water removal of electrical equipment may be summarized as follows:

- a) Toxicity due to direct exposure of aquatic invertebrates and fish within the work area to dissolved and particulate phase PCBs.
- b) Toxicity due to direct exposure of aquatic invertebrates and fish outside the work area (i.e. outside the turbidity screens) to soluble phase PCBs.
- c) Indirect exposure and bioaccumulation-related toxicity to semi-aquatic birds, mammals and predatory fish that may consume aquatic invertebrates and fish containing PCBs in their tissues.



- d) Toxicity to benthic aquatic invertebrates that may be exposed to residual PCBs in the sediments and bioaccumulation-related impacts to other biota that may consume these invertebrates.

## 7.0 RECOMMENDATIONS

### 7.1 STORMWATER DRAIN

The sediment in the stormwater drain should be removed and the area surrounding the outfalls (i.e. in the river) and the catch basins should be further investigated to determine the extent of contamination. Additionally, a regular maintenance program should be implemented to minimize the entrance of sediment into the storm drain system.

The USACE removed the sediment within the drain lines, and replaced the felt “socks” that lined the associated catch basins in October 2001. Additionally, the area surrounding the catch basins is currently being evaluated as part of the upland investigation.

### 7.2 IN-WATER PILES

The PCB-containing electrical equipment should be removed as soon as practical (e.g., during the upcoming fish-window: prior to early March 2002), to protect human and ecological receptors.

Removing the impacted sediments is not possible during this in-water period due to lack of time available to consider this issue, as well as the appropriate engineering and permitting needed to support this type of a cleanup operation. Therefore, if the equipment and sediment were to be addressed concurrently, it could probably not occur until 2003. Meanwhile, the equipment would probably continue to release PCBs to the environment. Acting now eliminates the possibility of the ongoing PCB release while only having modest impact on short-term exposure to aquatic biota.

The benefits of the recommended removal are three-fold: a reduction of the mass of PCBs available to be released to the environment; a long-term reduction of risk to sediment-associated biota; and a long-term reduction in the subsequent food-web transfer of PCBs from resident aquatic species to higher orders of fish and wildlife. It is unlikely that there would be significantly increased risks to potential ecological receptors as a result of the removal of the electrical equipment.

In summary, the removal of the PCB-containing electrical equipment is unlikely to result in increased risks to human or ecological receptors either inside or outside the work area. While there may be some short-term increase in direct exposure to some of the aquatic biota, this is not associated with significantly increased risks. In the long-term, the removal action will serve to decrease risks to ecological and human health by removing the continuing source of PCBs in the area.

The nature and extent of the impacts to the sediment should be investigated and the risks from the sediment should be determined.

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## TABLES

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**TABLE 3-1**  
**Sample Location and Analyses Summary**

Site Location	Sample Number, Location and/or Matrix	Analyses
<b>Water Column</b>		
Pile #1	3 x (Water, Particulate, and Sediment)	8082, 9060 (particulate and sediment only)
Pile #2	1 x (Water, Particulate, and Sediment)	8082, 9060 (particulate and sediment only)
Background Location	1 x (Water, Particulate, and Sediment)	8082, 9060 (particulate and sediment only)
<b>SPMD</b>		
Pile #1	1 x (Sampling Sheet)	8082
Pile #2	1 x (Sampling Sheet)	8082
Pile #3	1 x (Sampling Sheet)	8082
Background Location	1 x (Sampling Sheet)	8082
<b>River-Bottom Sediment</b>		
Pile #1	1 x Pile Perimeter	8082
	1 x Pile Perimeter	8082, 8081A, 8151A, 8270B, 6010/7000, 7471A, NWTPH-HCID, 9060, ASTM D422
Pile #2	2 x Pile Perimeter	8082
	2 x Pile Perimeter	8082, 8081A, 8151A, 8270B, 6010/7000, 7471A, NWTPH-HCID, 9060, ASTM D422
<b>Tissue</b>		
Pile #1	1 x (Clam Tissue), 1 x (Crawfish Tissue)	8082, Lipid Content
Pile #2	2 x (Clam Tissue), 2 x (Crawfish Tissue)	8082, Lipid Content
Background Location	1 x (Clam Tissue), 1 x (Crawfish Tissue)	8082, Lipid Content
<b>Drain Sampling</b>		
Sandblast Grit Building Drain System	1 x Drain Outlet #1 (Sediment and Pore Water)	8082, 6010/6020/7471, 8270C, 9060, NWTPH-HCID(Sediment Only) Krone (GC-MS) <sup>1</sup> (Sediment and Pore Water),
	1 x Drain Catch basin #1 (Sediment)	8082, 6010/6020/7471, 8260B, 8270C, 9060, NWTPH-HCID, Krone (GC-MS) <sup>1</sup>
	1 x Drain Outlet #2 (Sediment and Pore Water)	8082, 6010/6020/7471, 8270C, 9060, NWTPH-HCID(Sediment Only) Krone (GC-MS) <sup>1</sup> (Sediment and Pore Water),
	1 x Drain Catch basin #2 (Sediment)	8082, 6010/6020/7471, 8260B, 8270C, 9060, NWTPH-HCID, Krone (GC-MS) <sup>1</sup>

**Note:** <sup>1</sup>Ion Trap GC/MS method for organotin analysis developed for the Puget Sound Estuary Program.



**Table 3-2  
Crayfish Samples  
Size and Weight  
Bradford Island Landfill**

**Pile #1  
Sample ID 010503IW28TS**

Crayfish No.	Weight (g)	Length (mm)	Claw (mm)
1	12.6	7.2	3
2	11	8.5	3.5
3	12.5	7	4
4	10.5	6.5	3
5	11.1	7.62	2.54
6	7	6.35	2.54
<b>Average</b>	<b>10.8</b>	<b>7.2</b>	<b>3.1</b>

**Pile #2 - East  
Sample ID 010503IW27TS**

Crayfish No.	Weight (g)	Length (mm)	Claw (mm)
1	9.9	7.4	2.5
2	23	8.5	4.5
3	24	12.5	5.5
4	18.6	9	5
5	28.8	11.5	6
6	33	14.5	6.5
7	17.3	6.5	3
8	22.7	9	4
9	20.1	9.5	3.5
10	43.8	12	8
11	14	8	3
12	21.4	8	5
13	14.3	7.5	4
14	16.3	8	4
15	11.8	7	4.5
16	13.7	8	4
17	10	6	3
<b>Average</b>	<b>20.2</b>	<b>9.0</b>	<b>4.5</b>

**Background - Goose Island  
Sample ID 010509IW29TS**

Crayfish No.	Weight (g)	Length (mm)	Claw (mm)
1	57.5	16.51	5.08
2	22.3	7.62	3.175
3	6.5	5.08	1.905
<b>Average</b>	<b>28.8</b>	<b>9.7</b>	<b>3.4</b>

**Pile #2 - West  
Sample ID 010509IW26TS**

Crayfish No.	Weight (g)	Length (mm)	Claw (mm)
1	32.6	7.62	5.08
2	23.5	7.62	3.556
3	4.4	5.08	1.905
4	33.1	10.16	5.08
5	15.8	7.62	3.048
6	6.9	5.08	2.286
7	26.2	8.001	5.715
8	13.8	5.715	2.54
9	18.3	8.255	3.302
10	14	6.35	2.54
<b>Average</b>	<b>18.9</b>	<b>7.2</b>	<b>3.5</b>

**Duplicate of 010509IW26TS  
Sample ID 010509IW30TS**

Crayfish No.	Weight (g)	Length (mm)	Claw (mm)
1	31.3	9	4
2	14.8	8	3
3	43	10.5	5
4	43	11	4.5
5	33.5	9	3.5
6	18.2	8.5	4
7	9.2	6.5	3
8	15.9	8	3
9	25	8.5	3.5
10	23.8	9	3.5
11	15.7	8	2.5
12	10.5	6	2.5
13	17	8	3.25
14	16.1	8.5	3
15	2.1	4	1.5
16	20.4	7	2.5
17	12.1	7	2.5
18	8.7	6.75	2
19	13.4	8	2.5
20	7.7	6	2
21	8.9	7	2
22	12.7	7	2.5
23	10.4	6.5	2.5
<b>Average</b>	<b>18.0</b>	<b>7.7</b>	<b>3.0</b>

TABLE 4-1  
ANALYTICAL DATA SUMMARY  
BRADFORD ISLAND LANDFILL - IN WATER RESULTS - WATER COLUMN SAMPLES AND COLLOCATED SEDIMENT  
POLYCHLORINATED BIPHENYLS

Sample ID		010502IW03WCS/SS	010502IW04WCS/SS	010502IW05WCS	010502IW06WCS/SS	010502IW10WCS/SS	010502IW11WCS/SS	010502IW12SS	Freshwater Sediment Ecological Benchmark			
Area		Pile #1	Pile #1	Duplicate of 010502IW04WCS	Pile #1	Background Location	Pile #2	Duplicate of 010502IW11WCS	WQC	TEC	Lowest of Other Reference Levels	
Location		Within Pile	Within Pile	Within Pile	Within Pile	Goose Island	Within Pile	Within Pile				
Date Collected		5/2/2001 - 6/19/2001	5/2/2001 - 6/19/2001	5/2/2001 - 6/19/2001	5/2/2001 - 6/19/2001	5/2/2001 - 6/19/2001	5/2/2001 - 6/19/2001	5/2/2001 - 6/19/2001				
Water - Dissolved Phase												
Aroclor 1242	ug/L	0.0326 U	0.0321 U	0.0311 U	0.032 U	0.031 U	0.0299 U	NA	0.014	NV	--	--
Aroclor 1248	ug/L	0.0326 U	0.0321 U	0.0311 U	0.032 U	0.031 U	0.0299 U	NA	0.014	NV	--	--
Aroclor 1254	ug/L	0.265	0.038 J	0.0399	0.032 U	0.031 U	0.03 U	NA	0.014	NV	--	--
Aroclor 1260	ug/L	0.0326 U	0.0321 U	0.0311 U	0.032 U	0.031 U	0.0299 U	NA	0.014	NV	--	--
Water - Particulate Phase												
Aroclor 1242	ug/L	0.316 U	0.0316 U	0.0316 U	0.0316 U	0.0316 U	0.0316 U	NA	0.014	NV	--	--
Aroclor 1248	ug/L	0.316 U	0.0316 U	0.0316 U	0.0316 U	0.0316 U	0.0316 U	NA	0.014	NV	--	--
Aroclor 1254	ug/L	7.28	0.624	0.032 U	0.132	0.032 U	0.24	NA	0.014	NV	--	--
Aroclor 1260	ug/L	0.316 U	0.0316 U	0.0316 U	0.0316 U	0.0316 U	0.0316 U	NA	0.014	NV	--	--
Sediment									NOAA TEL	TEC	Lowest of Other Reference Levels	
Aroclor 1242	mg/Kg-dry	0.0021 U	0.002 U	NA	0.0019 U	0.00255 U	0.0021 U	0.00213 U	0.0341	0.0598	--	--
Aroclor 1248	mg/Kg-dry	0.0021 U	0.002 U	NA	0.0019 U	0.00255 U	0.0021 U	0.00213 U	0.0341	0.0598	--	--
Aroclor 1254	mg/Kg-dry	24 J	0.077	NA	0.092	0.018	1.24	0.417	0.0341	0.0598	--	--
Aroclor 1260	mg/Kg-dry	0.0021 U	0.002 U	NA	0.0019 U	0.00255 U	0.0021 U	0.00213 U	0.0341	0.0598	--	--
Total Organic Carbon	%	0.15	0.08	NA	0.19	0.47	0.42	0.23	NV	NV	--	--

**Notes:**  
Data presented herein reflect the concentrations, quantitation limits and qualifications as determined by the data validation process. The Data Validation Report is presented in Appendix C.  
Detections are in bold.  
Shaded concentrations are values above benchmark values.  
U - The analyte was not detected above the reported sample quantitation limit.  
J - The associated numerical value is an estimate.  
NA - Not analyzed  
NV - No value  
WQC - Ambient Water Quality Criteria (EPA 1999).  
NOAA TEL - Screening Quick Reference Table Threshold Effects Level.  
TEC - Threshold Effect Concentration (MacDonald et al. 2000).  
-- Not applicable since other value present.

TABLE 4-2  
ANALYTICAL DATA SUMMARY  
BRADFORD ISLAND LANDFILL - IN WATER RESULTS - SEDIMENTS  
PESTICIDES AND POLYCHLORINATED BIPHENYLS

Sample		010502IW07SS		010502IW08SS		010502IW01SS		010502IW02SS		010503IW16SS		010503IW13SS		010503IW14SS		010503IW15SS		010503IW17SS		Freshwater Sediment Ecological Benchmark Values			
Area		Pile #1		Pile #1		Pile #2		Pile #2		Pile #2		Pile #2		Pile #2		Pile #2		Pile #2		NOAA TEL	TEC	Lowest of Other Reference Levels	
Location		Perimeter		Perimeter		East Perimeter		East Perimeter		West Perimeter		West Perimeter		Within Pile		Duplicate of 14 SS		Within Pile					
Date Collected		5/2/2001		5/2/2001		5/2/2001		5/2/2001		5/3/2001		5/3/2001		5/3/2001		5/3/2001		5/3/2001					
PCBs																							
Aroclor 1016	mg/kg-dry	0.01	U	0.014	U	0.01	U	0.012	U	0.01	U	0.013	U	0.01	U	0.01	U	0.012	U	0.0341	0.0598	--	
Aroclor 1221	mg/kg-dry	0.021	U	0.014	U	0.021	U	0.012	U	0.021	U	0.013	U	0.021	U	0.021	U	0.012	U	0.0341	0.0598	--	
Aroclor 1232	mg/kg-dry	0.01	U	0.014	U	0.01	U	0.012	U	0.01	U	0.013	U	0.01	U	0.01	U	0.012	U	0.0341	0.0598	--	
Aroclor 1242	mg/kg-dry	0.01	U	0.014	U	0.01	U	0.012	U	0.01	U	0.013	U	0.01	U	0.01	U	0.012	U	0.0341	0.0598	--	
Aroclor 1248	mg/kg-dry	0.01	U	0.014	U	0.01	U	0.012	U	0.01	U	0.013	U	0.01	U	0.01	U	0.012	U	0.0341	0.0598	--	
Aroclor 1254	mg/kg-dry	0.01	U	0.014	U	0.01	U	0.2		0.044		0.35		0.51		0.57		1.1		0.0341	0.0598	--	
Aroclor 1260	mg/kg-dry	0.01	U	0.014	U	0.01	U	0.012	U	0.01	U	0.013	U	0.01	U	0.01	U	0.012	U	0.0341	0.0598	--	
Pesticides																							
Aldrin	ug/kg-dry	1	U	NA		1	U	NA		1	U	NA		1	U	1	U	NA		NV	NV	2	Ontario LEL
alpha-BHC	ug/kg-dry	1	U	NA		1	U	NA		1	U	NA		1	U	1	U	NA		NV	NV	6	Ontario LEL
beta-BHC	ug/kg-dry	1	U	NA		1	U	NA		1	U	NA		1	U	1	U	NA		NV	NV	5	Ontario LEL
delta-BHC	ug/kg-dry	1	U	NA		1	U	NA		1	U	NA		1	U	1	U	NA		NV	NV	120	ORNL
gamma-BHC (Lindane)	ug/kg-dry	1	U	NA		1	U	NA		1	U	NA		1	U	1	U	NA		0.94	NV	--	
Chlordane (technical)	ug/kg-dry	10	U	NA		10	U	NA		9	U	NA		10	U	11	U	NA		4.5	3.24	--	
4,4'-DDD	ug/kg-dry	2	U	NA		2	U	NA		0.8	J	NA		2	U	2	U	NA		3.54	4.88	--	
4,4'-DDE	ug/kg-dry	2	U	NA		2	U	NA		0.5	J	NA		2	U	6	U	NA		1.42	3.16	--	
4,4'-DDT	ug/kg-dry	2	U	NA		1.7	J	NA		2	U	NA		2	U	2	U	NA		NV	4.16	--	
Dieldrin	ug/kg-dry	2	U	NA		2	U	NA		2	U	NA		10	U	9	U	NA		2.85	1.9	--	
Endosulfan I	ug/kg-dry	1	U	NA		1	U	NA		1	U	NA		1	U	1	U	NA		NV	NV	5.4	OSWER
Endosulfan II	ug/kg-dry	2	U	NA		2	U	NA		2	U	NA		2	U	2	U	NA		NV	NV	5.4	OSWER
Endosulfan sulfate	ug/kg-dry	2	U	NA		2	U	NA		2	U	NA		2	U	2	U	NA		NV	NV	NV	
Endrin	ug/kg-dry	2	U	NA		2	U	NA		2	U	NA		4	U	3	U	NA		2.67	2.22	--	
Endrin aldehyde	ug/kg-dry	2	U	NA		2	U	NA		2	U	NA		4	U	5	U	NA		NV	NV	NV	
Heptachlor	ug/kg-dry	1	U	NA		1	U	NA		1	U	NA		1	U	1	U	NA		NV	NV	68	ORNL
Heptachlor epoxide	ug/kg-dry	1	U	NA		1	U	NA		1	U	NA		4	U	3	U	NA		0.6	2.47	--	
Methoxychlor	ug/kg-dry	10	U	NA		10	U	NA		9	U	NA		10	U	11	U	NA		NV	NV	19	ORNL & OSWER
Endrin ketone	ug/kg-dry	2	U	NA		2	U	NA		2	U	NA		2	U	2	U	NA		NV	NV	NV	
Toxaphene	ug/kg-dry	100	U	NA		100	U	NA		91	U	NA		100	U	110	U	NA		NV	NV	28	OSWER

Notes:  
Data presented herein reflect the concentrations, quantitation limits and qualifications as determined by the data validation process. The Data Validation Report is presented in Appendix C.  
Detections are in bold.  
Shaded concentrations are values above benchmark values.  
Second column confirmation was performed and the relative percent difference value between the results on the two columns is ≤ 40%, unless otherwise noted.  
NV - No Value  
NA - Not Applicable  
J - The associated numerical value is an estimate.  
U - The analyte was not detected above the reported sample quantitation limit.  
-- Not applicable since TEL or TEC are present.  
**Ecological Benchmark Values:**  
NOAA TEL - Screening Quick Reference Table Threshold Effects Level.  
TEC - Threshold Effect Concentration (MacDonald et al. 2000).  
Ontario LEL - Ontario Ministry of the Environment Lowest Effect Level.  
ORNL - Oak Ridge National Laboratory Secondary Chronic Values.

**TABLE 4-3**  
**ANALYTICAL DATA SUMMARY**  
**BRADFORD ISLAND LANDFILL - IN WATER RESULTS - SEDIMENTS**  
**TOTAL ORGANIC CARBON**

Sample		010502IW07SS	010502IW08SS	010502IW01SS	010502IW02SS	010502IW16SS	010503IW13SS	010502IW14SS	010502IW15SS	010503IW17SS
Area		Pile #1	Pile #1	Pile #2	Pile #2	Pile #2	Pile #2	Pile #2	Pile #2	Pile #2
Location		Perimeter	Perimeter	East Perimeter	East Perimeter	West Perimeter	West Perimeter	Within Pile	Duplicate of 14 SS	Within Pile
Date Collected		5/2/2001	5/2/2001	5/2/2001	5/2/2001	5/3/2001	5/3/2001	5/3/2001	5/3/2001	5/3/2001
Total Organic Carbon	mg/kg-dry	1500	390	1900	1300	1500	1300	3800	2900	2400
	%	0.15	0.039	0.19	0.13	0.15	0.13	0.38	0.29	0.24

Data presented herein reflect the concentrations, quantitation limits and qualifications as determined by the data validation process.  
The Data Validation Report is presented in Appendix C.

TABLE 4-4  
ANALYTICAL DATA SUMMARY  
BRADFORD ISLAND LANDFILL - IN WATER RESULTS - SEDIMENTS  
SEMIVOLATILE ORGANIC COMPOUNDS

Sample		010502IW07SS	010502IW01SS	010503IW16SS	010503IW14SS	010503IW15SS	Freshwater Sediment Ecological Benchmark Values			
Area		Pile #1	Pile #2	Pile #2	Pile #2	Pile #2	NOAA TEL	TEC	Lowest of Other Reference Levels	
Location		Perimeter	East Perimeter	West Perimeter	Within Pile	Duplicate of 14 SS				
Date Collected		5/2/2001	5/2/2001	5/3/2001	5/3/2001	5/3/2001				
1,2,4-Trichlorobenzene	ug/kg	17 U	16 U	16 U	17 U	17 U	NV	NV	9200	OSWER
1,2-Dichlorobenzene	ug/kg	17 U	16 U	16 U	17 U	17 U	NV	NV	330	ORNL
1,3-Dichlorobenzene	ug/kg	17 U	16 U	16 U	17 U	17 U	NV	NV	1700	ORNL & OSWER
1,4-Dichlorobenzene	ug/kg	17 U	16 U	16 U	17 U	17 U	NV	NV	340	ORNL
2,4,5-Trichlorophenol	ug/kg	17 U	16 U	16 U	17 U	17 U	NV	NV	NV	
2,4,6-Trichlorophenol	ug/kg	17 U	16 U	16 U	17 U	17 U	NV	NV	NV	
2,4-Dichlorophenol	ug/kg	17 U	16 U	16 U	17 U	17 U	NV	NV	NV	
2,4-Dimethylphenol	ug/kg	17 U	16 U	16 U	17 U	17 U	NV	NV	NV	
2,4-Dinitrophenol	ug/kg	17 U	16 U	16 U	17 U	17 U	NV	NV	NV	
2,4-Dinitrotoluene	ug/kg	17 U	16 U	16 U	17 U	17 U	NV	NV	NV	
2,6-Dinitrotoluene	ug/kg	17 U	16 U	16 U	17 U	17 U	NV	NV	NV	
2-Chloronaphthalene	ug/kg	9 U	8 U	8 U	8 U	9 U	NV	NV	NV	
2-Chlorophenol	ug/kg	17 U	16 U	16 U	17 U	17 U	NV	NV	NV	
2-Methylnaphthalene	ug/kg	9 U	8 U	8 U	8 U	9 U	NV	NV	20.2	Canadian ISQGs
2-Methylphenol	ug/kg	17 U	16 U	16 U	17 U	17 U	NV	NV	12	ORNL
2-Nitroaniline	ug/kg	17 U	16 U	16 U	17 U	17 U	NV	NV	NV	
2-Nitrophenol	ug/kg	17 U	16 U	16 U	17 U	17 U	NV	NV	NV	
3- & 4-Methylphenol	ug/kg	17 U	16 U	16 U	17 U	17 U	NV	NV	670	WA State
3,3'-Dichlorobenzidine	ug/kg	17 U	16 U	16 U	17 U	17 U	NV	NV	NV	
3-Nitroaniline	ug/kg	17 U	16 U	16 U	17 U	17 U	NV	NV	NV	
4,6-Dinitro-2-methylphenol	ug/kg	43 U	40 U	39 U	42 U	43 U	NV	NV	NV	
4-Bromophenylphenylether	ug/kg	17 U	16 U	16 U	17 U	17 U	NV	NV	1200	ORNL
4-Chloro-3-methylphenol	ug/kg	17 U	16 U	16 U	17 U	17 U	NV	NV	NV	
4-Chloroaniline	ug/kg	17 U	16 U	16 U	17 U	17 U	NV	NV	NV	
4-Chlorophenylphenylether	ug/kg	17 U	16 U	16 U	17 U	17 U	NV	NV	NV	
4-Nitroaniline	ug/kg	17 U	16 U	16 U	17 U	17 U	NV	NV	NV	
4-Nitrophenol	ug/kg	17 U	16 U	16 U	17 U	17 U	NV	NV	NV	
Acenaphthene	ug/kg	9 U	8 U	8 U	8 U	9 U	NV	NV	620	OSWER
Acenaphthylene	ug/kg	9 U	8 U	8 U	8 U	9 U	NV	NV	NV	
Anthracene	ug/kg	9 U	8 U	12	8 U	9 U	NV	57.2	--	
Benz(a)anthracene	ug/kg	17 U	16 U	59	17 U	7 J	31.7	108	--	
Benzidine	ug/kg	17 U	16 U	16 U	17 U	70 U	NV	NV	1.7	ORNL
Benzo(a)pyrene	ug/kg	9 U	8 U	78	8 U	5 J	31.9	150	--	
Benzo(b)fluoranthene	ug/kg	9 U	8 U	87	8 U	12	NV	NV	27.2	ARCS TEC
Benzo(g,h,i)perylene	ug/kg	9 U	8 U	30	8 U	9 U	NV	NV	170	Ontario LEL
Benzo(k)fluoranthene	ug/kg	9 U	8 U	8 U	8 U	9 U	27.2	NV	--	
Benzoic Acid	ug/kg	43 UJ	40 UJ	39 UJ	42 UJ	43 UJ	NV	NV	NV	
Benzyl Alcohol	ug/kg	17 U	16 U	16 U	17 U	17 U	NV	NV	NV	
bis(2-Chloroethoxy)methane	ug/kg	17 U	16 U	16 U	17 U	17 U	NV	NV	NV	
bis(2-Chloroethyl)ether	ug/kg	17 U	16 U	16 U	17 U	17 U	NV	NV	NV	
bis(2-Chloroisopropyl)ether	ug/kg	17 U	16 U	16 U	17 U	17 U	NV	NV	NV	
bis(2-Ethylhexyl)phthalate	ug/kg	190 U	42 U	57 U	140 U	43 U	NV	NV	182	Region IV
Butylbenzylphthalate	ug/kg	17 U	17 U	20 U	17 U	17 U	NV	NV	11000	ORNL & OSWER
Carbazole	ug/kg	43 U	40 U	39 U	42 U	43 U	NV	NV	NV	
Chrysene	ug/kg	9 U	8 U	58	8 U	7 J	26.83	166	--	
Dibenz(a,h)anthracene	ug/kg	9 U	8 U	8 U	8 U	9 U	10	33	--	
Dibenzofuran	ug/kg	17 U	16 U	16 U	17 U	17 U	NV	NV	420	ORNL
Diethylphthalate	ug/kg	17 U	16 U	16 U	17 U	17 U	NV	NV	600	ORNL
Dimethylphthalate	ug/kg	17 U	16 U	16 U	17 U	17 U	NV	NV	NV	
Di-n-butylphthalate	ug/kg	85 U	30 U	78 U	84 U	87 U	NV	NV	11000	ORNL & OSWER
Di-n-octylphthalate	ug/kg	17 U	16 U	16 U	17 U	17 U	NV	NV	NV	
Fluoranthene	ug/kg	9 U	8 U	98	8 U	18	31.46	423	--	
Fluorene	ug/kg	9 U	8 U	8 U	8 U	9 U	10	77.4	--	
Hexachlorobenzene	ug/kg	17 U	16 U	16 U	17 U	17 U	NV	NV	NV	
Hexachlorobutadiene	ug/kg	17 U	16 U	16 U	17 U	17 U	NV	NV	NV	
Hexachlorocyclopentadiene	ug/kg	17 U	16 U	16 U	17 U	17 U	NV	NV	NV	
Hexachloroethane	ug/kg	17 U	16 U	16 U	17 U	17 U	NV	NV	1000	ORNL
Indeno(1,2,3-cd)pyrene	ug/kg	9 U	8 U	29	8 U	9 U	17.32	NV	--	
Isophorone	ug/kg	17 U	16 U	16 U	17 U	17 U	NV	NV	NV	
Naphthalene	ug/kg	9 U	8 U	8 U	8 U	9 U	NV	176	--	
Nitrobenzene	ug/kg	17 U	16 U	16 U	17 U	17 U	NV	NV	NV	
N-nitrosodimethylamine	ug/kg	17 U	16 U	16 U	17 U	17 U	NV	NV	NV	
N-nitroso-di-n-propylamine	ug/kg	17 U	16 U	16 U	42 U	17 U	NV	NV	NV	
N-Nitrosodiphenylamine	ug/kg	17 U	16 U	16 U	17 U	17 U	NV	NV	NV	
Pentachlorophenol (PCP)	ug/kg	17 U	16 U	16 U	17 U	17 U	NV	NV	NV	
Phenanthrene	ug/kg	9 U	8 U	35	8 U	7 J	18.73	204	--	
Phenol	ug/kg	17 U	16 U	16 U	17 U	17 U	NV	NV	31	ORNL
Pyrene	ug/kg	9 U	8 U	100	8 U	19	44.27	195	--	

**Notes:**  
Data presented herein reflect the concentrations, quantitation limits and qualifications as determined by the data validation process.  
The Data Validation Report is presented in Appendix C.  
Detections are in bold.  
Shaded concentrations are values above benchmark values.  
NV - No Value  
J - The associated numerical value is an estimate.  
U - The analyte was not detected above the reported sample quantitation limit.  
Elevated MRLs for diethylphthalate, di-n-butylphthalate, butylbenzylphthalate and bis(20ethylhexyl)phthalate are a result of blank contaminant.  
-- Not applicable since TEL or TEC are present.

**Ecological Benchmark Values:**  
NOAA TEL - Screening Quick Reference Table Threshold Effects Level.  
TEC - Threshold Effect Concentration (MacDonald et al. 2000).  
WA State - Washington State Sediment Quality Criteria "no effects" level.  
ARCS TEC - Assessment and Remediation of Contaminated Sediment (ARCS) Project Threshold Effect Concentration.  
ORNL - Oak Ridge National Laboratory Secondary Chronic Values.  
OSWER - Office of Solid Waste and Emergency Response.  
Region IV - U.S. EPA Region IV Ecological Screening Value.

**TABLE 4-5  
ANALYTICAL DATA SUMMARY  
BRADFORD ISLAND LANDFILL - IN WATER RESULTS - SEDIMENTS  
HERBICIDES**

Sample ID		010502IW07SS	010502IW01SS	010502IW16SS	010502IW14SS	010502IW15SS	Freshwater Sediment Ecological Benchmark Values			
Area		Pile #1	Pile #2	Pile #2	Pile #2	Downstream Pile #2	NOAA TEL	TEC	Lowest of Other Reference Levels	
Location		Perimeter	East Perimeter	West Perimeter	Within Pile	Duplicate of 14 SS				
Date Collected		5/2/2001	5/2/2001	5/3/2001	5/3/2001	5/3/2001				
2,4,5-T	ug/Kg-dry	9 U	8 U	8 U	9 U	9 U	NV	NV	NV	
2,4-D	ug/Kg-dry	9 U	8 U	8 U	9 U	9 U	NV	NV	NV	
2,4-DB	ug/Kg-dry	9 U	8 U	8 U	9 U	9 U	NV	NV	NV	
4-Nitrophenol	ug/Kg-dry	9 U	8 U	8 U	9 U	9 U	NV	NV	NV	
Dalapon	ug/Kg-dry	9 U	8 U	8 U	9 U	9 U	NV	NV	NV	
Dicamba	ug/Kg-dry	9 U	8 U	8 U	9 U	9 U	NV	NV	NV	
Dichloroprop	ug/Kg-dry	9 U	8 U	8 U	9 U	9 U	NV	NV	NV	
Dinoseb	ug/Kg-dry	9 U	8 U	8 U	9 U	9 U	NV	NV	NV	
MCPA	ug/Kg-dry	9 U	8 U	8 U	9 U	9 U	NV	NV	NV	
MCPP	ug/Kg-dry	9 U	8 U	8 U	9 U	9 U	NV	NV	NV	
Pentachlorophenol (PCP)	ug/Kg-dry	9 U	8 U	8 U	9 U	9 U	NV	NV	NV	
Silvex (2,4,5-TP)	ug/Kg-dry	9 U	8 U	8 U	9 U	9 U	NV	NV	NV	

**Notes:**

Data presented herein reflect the concentrations, quantitation limits and qualifications as determined by the data validation process. The Data Validation Report is presented in Appendix C.

NV - No Value

U - The analyte was not detected above the reported sample quantitation limit.

UJ - The analyte was not detected above the reported, estimated sample quantitation limit.

TABLE 4-6  
ANALYTICAL DATA SUMMARY  
BRADFORD ISLAND LANDFILL - IN WATER RESULTS - SEDIMENTS  
METALS

Sample ID	010502IW07SS	010502IW01SS	010503IW16SS	010503IW14SS	010503IW15SS	Background Sediment Values		Freshwater Sediment Ecological Benchmark Values				
Area	Pile #1	Pile #2	Pile #2	Pile #2	Pile #2			NOAA TEL	TEC	Lowest of Other Reference Levels		
Location	Perimeter	East Perimeter	West Perimeter	Within Pile	Duplicate of 14SS	LCR Rec						
Date Collected	5/2/2001	5/2/2001	5/3/2001	5/3/2001	5/3/2001	Range	Average					
Aluminum	mg/kg-dry	12000	12000	9500	11000	13000	2794-10850	7079	NV	NV	58030	
Antimony	mg/kg-dry	0.72 U	0.62 U	0.7 U	0.7 U	0.73 U	4.32-6.78	5.19	NV	NV	2	NY LEL
Arsenic	mg/kg-dry	2.4	4.3	4.3	2.4	2.7	0.6-4.1	2.46	5.9	9.79	--	
Barium	mg/kg-dry	74	95	83	88	95	28.2-164.5	96.66	NV	NV	NV	
Beryllium	mg/kg-dry	0.24	0.23	0.21	0.27	0.30	2.82-4.64	3.52	NV	NV	NV	
Cadmium	mg/kg-dry	0.62*	0.73*	0.7*	1*	1*	NV	0.44	0.596	0.99	--	
Calcium	mg/kg-dry	7000	4400	5100	4200	6000	NV	NV	NV	NV	NV	
Chromium	mg/kg-dry	18	17	20	16	22	2.4-9.95	7.41	37.3	43.4	--	
Cobalt	mg/kg-dry	17	9.6	12	8.6	13	NV	NV	NV	NV	NV	
Copper	mg/kg-dry	50	27	32	27	37	3.8-17.83	9.21	35.7	31.6	--	
Iron	mg/kg-dry	30000	21000	25000	18000	24000	8861-17742	12,342	NV	NV	20000	NY LEL & Ontario LEL
Lead	mg/kg-dry	6.2	7.9	12	9.3	9.0	1.41-13.24	7.92	35	35.8	--	
Magnesium	mg/kg-dry	12000	6000	6500	4600	8200	NV	0.07	NV	NV	NV	
Manganese	mg/kg-dry	380	340	470	380	600	NV	NV	NV	NV	460	NY LEL & Ontario LEL
Mercury	mg/kg-dry	0.051 J	0.065 J	0.017 J	0.035 J	0.025 U	0.058-0.107	NV	0.174	0.18	--	
Nickel	mg/kg-dry	22	8.5	11	7.6	11	4.21-14.19	10.55	18	22.7	--	
Selenium	mg/kg-dry	0.31 J	0.26 J	0.2 J	0.7 U	0.73 U	0.29-0.90	0.39	NV	NV	NV	
Silver	mg/kg-dry	0.11 J	0.14	0.13	0.16	0.18	0.28-0.41	0.31	4.5	NV	--	
Thallium	mg/kg-dry	0.17	0.15	0.21	0.16	0.17	10.36-16.27	12.46	NV	NV	NV	
Potassium	mg/kg-dry	500	950	750	1100	1100	NV	NV	NV	NV	NV	
Vanadium	mg/kg-dry	49	45	56	44	58	NV	NV	NV	NV	NV	
Zinc	mg/kg-dry	92	78	91	73	89	22.5-161.3	80.03	123	121	--	

**Notes:**  
Data presented herein reflect the concentrations, quantitation limits and qualifications as determined by the data validation process. The Data Validation Report is presented in Appendix C.  
Detections are in bold.  
Shaded concentrations are values above benchmark values.  
\*Values are similar to or below background sediment values.  
NV - No Value  
J - The associated numerical value is an estimate.  
U - The analyte was not detected above the reported sample quantitation limit.  
UJ - The analyte was not detected above the reported, estimated sample quantitation limit.  
-- Not applicable since TEL or TEC are present.

**Ecological Benchmark Values:**  
NOAA TEL - Screening Quick Reference Table Threshold Effects Level.  
TEC - Threshold Effect Concentration (MacDonald et al. 2000).  
NY LEL - New York State Sediment Lowest Effect Level for Metals.



**TABLE 4-7**  
**ANALYTICAL DATA SUMMARY**  
**BRADFORD ISLAND LANDFILL - IN WATER RESULTS - SEDIMENTS**  
**TOTAL PETROLEUM HYDROCARBONS**

Sample ID		010502IW07SS	010502IW01SS	010502IW16SS	010502IW14SS	010502IW15SS
Area		Pile #1	Pile #2	Pile #2	Pile #2	Pile #2
Location		Perimeter	East Perimeter	West Perimeter	Within Pile	Duplicate of 14 SS
Date Collected		5/2/2001	5/2/2001	5/3/2001	5/3/2001	5/3/2001
TPH (diesel-range)	mg/kg-dry	62 U	63 U	57 U	61 U	62 U
TPH (gasoline-range)	mg/kg-dry	25 U	25 U	23 U	24 U	25 U
TPH (lube-oil range)	mg/kg-dry	120 U	130 U	110 U	120 U	120 U

Data presented herein reflect the concentrations, quantitation limits and qualifications as determined by the data validation process.

The Data Validation Report is presented in Appendix C.

U - The analyte was not detected above the reported sample quantitation limit.

**TABLE 4-8**  
**ANALYTICAL DATA SUMMARY**  
**BRADFORD ISLAND LANDFILL - IN WATER RESULTS - SEDIMENTS**  
**GRAIN SIZE**

<b>Sample ID</b>		<b>010502IW08SS</b>	<b>010502IW02SS</b>	<b>010503IW13SS</b>
<b>Area</b>		<b>Pile #1</b>	<b>Pile #2</b>	<b>Pile #2</b>
<b>Location</b>		<b>Perimeter</b>	<b>East Perimeter</b>	<b>West Perimeter</b>
<b>Date Collected</b>		<b>5/2/2001</b>	<b>5/2/2001</b>	<b>5/3/2001</b>
<b>Gravel (12.5-4.75mm)</b>	%	54.2	38.3	44.6
<b>Sand (4.74-0.063mm)</b>	%	44.4	61.4	52.8
<b>Clay/Silt (&lt;0.063mm)</b>	%	1.4	0.3	2.6

**TABLE 4-9**  
**ANALYTICAL DATA SUMMARY**  
**BRADFORD ISLAND LANDFILL - IN WATER RESULTS - SEMIPERMEABLE MEMBRANE DEVICE SAMPLES**  
**POLYCHLORINATED BIPHENYLS**

Sample ID		010619RQ05		010619RQ02		010619RQ03		010619RQ01		010619RQ06	
Area		Pile #1		Pile #2		Pile #2		Pile #2		Background Location	
Location		West Perimeter		East Perimeter		Duplicate of 010619RQ02		West Perimeter		Goose Island	
Date Collected		9/20/2001		9/20/2001		9/20/2001		9/20/2001		9/20/2001	
Aroclor 1242	ng/SPMD	32.6	U	32.6	U	32.6	U	32.6	U	32.6	U
Aroclor 1248	ng/SPMD	32.6	U	32.6	U	32.6	U	32.6	U	32.6	U
Aroclor 1254	ng/SPMD	32.6	U	32.6	U	32.6	U	32.6	U	32.6	U
Aroclor 1260	ng/SPMD	32.6	U	32.6	U	32.6	U	32.6	U	32.6	U

**Notes:**

Data presented herein reflect the concentrations, quantitation limits and qualifications as determined by the data validation process.

The Data Validation Report is presented in Appendix C.

U - The analyte was not detected above the reported sample quantitation limit.

**TABLE 4-10**  
**ANALYTICAL DATA SUMMARY**  
**BRADFORD ISLAND LANDFILL - IN WATER RESULTS - TISSUE**  
**POLYCHLORINATED BIPHENYLS**

Sample ID - Clams		010502IW09TS	010502IW23TS	010502IW24TS	010502IW22TS	NA	010502IW21TS
Sample ID - Crayfish		010509IW28TS	010509IW27TS	NA	010509IW26TS	010509IE30TS	010509IW29TS
Area		Pile #1	Pile #2	Pile #2	Pile #2	Pile #2	Background Location
Location		Within Pile	East End	Duplicate of 010502IW23TS	West End	Duplicate of 010509IW26TS	Goose Island
Date Collected		5/2/2001	5/3/2001	5/3/2001	5/3/2001	5/3/2001	5/3/2001
Clam Tissue							
Aroclor 1242	ug/Kg-wet	14.2 U	14.1 U	13.9 U	14.3 U	NA	14.2 U
Aroclor 1248	ug/Kg-wet	14.2 U	14.1 U	13.9 U	14.3 U	NA	14.2 U
Aroclor 1254	ug/Kg-wet	<b>604</b>	<b>345</b>	<b>451</b>	<b>344</b>	NA	<b>23.8</b>
Aroclor 1260	ug/Kg-wet	14.2 U	14.1 U	13.9 U	14.3 U	NA	14.2 U
Lipid Content	%	3.33	3.91	4.92	3.16	NA	3.05
CrayfishTissue							
Aroclor 1242	ug/Kg-wet	15.4 U	14.3 U	NA	13.5 U	15.4 U	14.3 U
Aroclor 1248	ug/Kg-wet	15.4 U	14.3 U	NA	13.5 U	15.4 U	14.3 U
Aroclor 1254	ug/Kg-wet	<b>75600 J</b>	<b>11900</b>	NA	<b>2670</b>	<b>3970</b>	<b>268</b>
Aroclor 1260	ug/Kg-wet	15.4 U	14.3 U	NA	13.5 U	15.4 U	14.3 U
Lipid Content	%	5.74 M	5.61	NA	6.06	5.54	5.74 M

**Notes:**

Data presented herein reflect the concentrations, quantitation limits and qualifications as determined by the data validation process. The Data Validation Report is presented in Appendix C.

Detections are in bold.

U - The analyte was not detected above the reported sample quantitation limit.

J - The associated numerical value is an estimate.

M - Insufficient sample; mean value reported.

NA - Not analyzed

The number and sizes of crayfish collected and analyzed are presented in Table 3-2.

**TABLE 4-11**  
**ANALYTICAL DATA SUMMARY**  
**BRADFORD ISLAND - SANDBLAST DRAIN SYSTEM - SEDIMENTS**  
**POLYCHLORINATED BIPHENYLS**

Sample		010501SBMS01SS	010501SBMS02SS	010503SBDS19SS	010504SBDS24SS	010503SBDS18SS	Freshwater Sediment Ecological Benchmark Values	
Location		Catch Basin #1 (In catch basin)	Duplicate of 01SS	Drain outfall #1	Catch Basin #2 (directly above catch basin)	Drain outfall #2	NOAA TEL	TEC
Date Collected		5/1/2001	5/1/2001	5/3/2001	5/4/2001	5/3/2001		
Aroclor 1016	mg/kg-dry	0.014 U	0.012 U	0.013 U	0.026 U	0.013 U	0.0341	0.0598
Aroclor 1221	mg/kg-dry	0.014 U	0.012 U	0.013 U	0.026 U	0.013 U	0.0341	0.0598
Aroclor 1232	mg/kg-dry	0.014 U	0.012 U	0.013 U	0.026 U	0.013 U	0.0341	0.0598
Aroclor 1242	mg/kg-dry	0.014 U	0.012 U	0.013 U	0.026 U	0.013 U	0.0341	0.0598
Aroclor 1248	mg/kg-dry	0.014 U	0.012 U	0.013 U	0.026 U	0.013 U	0.0341	0.0598
Aroclor 1254	mg/kg-dry	0.014 U	0.012 U	0.013 U	0.026 U	0.013 U	0.0341	0.0598
Aroclor 1260	mg/kg-dry	0.014 U	<b>0.057</b>	<b>0.095</b>	<b>0.018</b> J	<b>0.017</b>	0.0341	0.0598

**Notes:**

Data presented herein reflect the concentrations, quantitation limits and qualifications as determined by the data validation process. The Data Validation Report is presented in Appendix C.

Detections are in bold.

Shaded concentrations are values above benchmark values.

NV - No Value

J - The associated numerical value is an estimate.

U - The analyte was not detected above the reported sample quantitation limit.

**Ecological Benchmark Values:**

NOAA TEL - Screening Quick Reference Table Threshold Effects Level.

**TABLE 4-12**  
**ANALYTICAL DATA SUMMARY**  
**BRADFORD ISLAND - SANDBLAST DRAIN SYSTEM - SEDIMENTS**  
**TOTAL ORGANIC CARBON**

Sample ID		010501SBMS01SS	010501SBMS02SS	010503SBDS19SS	010504SBDS24SS	010503SBDS18SS
Location		Catch Basin #1 (In catch basin)	Duplicate of 01SS	Drain outfall #1	Catch Basin #2 (directly above catch basin)	Drain outfall #2
Date Collected		5/1/2001	5/1/2001	5/3/2001	5/4/2001	5/3/2001
TOC	mg/kg-dry	12000	11000	4100	20000	12000
TOC	%	1.2	1.1	0.41	2	1.2

Data presented herein reflect the concentrations, quantitation limits and qualifications as determined by the data validation process.  
The Data Validation Report is presented in Appendix C.

TABLE 4-13  
ANALYTICAL DATA SUMMARY  
BRADFORD ISLAND - SANDBLAST DRAIN SYSTEM - SEDIMENTS  
SEMIVOLATILE ORGANIC COMPOUNDS

Sample		010501SBMS01SS	010501SBMS02SS	010503SBDS19SS	010504SBDS24SS	010503SBDS18SS	Freshwater Sediment Ecological Benchmark Values			
Location		Catch Basin #1 (In catch basin)	Duplicate of 01SS	Drain outfall #1	Catch Basin #2 (directly above catch basin)	Drain outfall #2	NOAA TEL	TEC	Lowest of Other Reference Levels	
Date Collected		5/1/2001	5/1/2001	5/3/2001	5/4/2001	5/3/2001				
1,2,4-Trichlorobenzene	ug/kg-dry	180 U	170 U	17 U	340 U	170 U	NV	NV	9200	OSWER
1,2-Dichlorobenzene	ug/kg-dry	180 U	170 U	17 U	340 U	170 U	NV	NV	330	ORNL
1,3-Dichlorobenzene	ug/kg-dry	180 U	170 U	17 U	340 U	170 U	NV	NV	1700	ORNL & OSWER
1,4-Dichlorobenzene	ug/kg-dry	180 U	170 U	17 U	340 U	170 U	NV	NV	340	ORNL
2,4,5-Trichlorophenol	ug/kg-dry	180 U	170 U	17 U	340 U	170 U	NV	NV	NV	
2,4,6-Trichlorophenol	ug/kg-dry	180 U	170 U	17 U	340 U	170 U	NV	NV	NV	
2,4-Dichlorophenol	ug/kg-dry	180 U	170 U	17 U	340 U	170 U	NV	NV	NV	
2,4-Dimethylphenol	ug/kg-dry	180 U	170 U	17 U	340 U	170 U	NV	NV	NV	
2,4-Dinitrophenol	ug/kg-dry	180 U	170 U	17 U	340 U	170 U	NV	NV	NV	
2,4-Dinitrotoluene	ug/kg-dry	180 U	170 U	17 U	340 UJ	170 U	NV	NV	NV	
2,6-Dinitrotoluene	ug/kg-dry	180 U	170 U	17 U	340 U	170 U	NV	NV	NV	
2-Chloronaphthalene	ug/kg-dry	180 U	170 U	17 U	340 U	170 U	NV	NV	NV	
2-Chlorophenol	ug/kg-dry	180 U	170 U	17 U	340 U	170 U	NV	NV	NV	
2-Methylnaphthalene	ug/kg-dry	180 U	170 U	9 U	170 U	170 U	NV	NV	20.2	Canadian ISQGs
2-Methylphenol	ug/kg-dry	180 U	170 U	17 U	340 U	170 U	NV	NV	12	ORNL
2-Nitroaniline	ug/kg-dry	180 U	170 U	17 U	340 U	170 U	NV	NV	NV	
2-Nitrophenol	ug/kg-dry	180 U	170 U	17 U	340 U	170 U	NV	NV	NV	
3- & 4-Methylphenol	ug/kg-dry	85 J	69 J	72	370	58 J	NV	NV	670	WA State
3,3'-Dichlorobenzidine	ug/kg-dry	180 U	170 U	17 U	340 U	170 U	NV	NV	NV	
3-Nitroaniline	ug/kg-dry	180 U	170 U	17 U	340 U	170 U	NV	NV	NV	
4,6-Dinitro-2-methylphenol	ug/kg-dry	450 U	420 U	44 U	850 UJ	420 U	NV	NV	NV	
4-Bromophenylphenylether	ug/kg-dry	180 U	170 U	17 U	340 U	170 U	NV	NV	1200	ORNL
4-Chloro-3-methylphenol	ug/kg-dry	180 U	170 U	17 U	340 U	170 U	NV	NV	NV	
4-Chloroaniline	ug/kg-dry	180 U	170 U	17 U	340 UJ	170 U	NV	NV	NV	
4-Chlorophenylphenylether	ug/kg-dry	180 U	170 U	17 U	340 U	170 U	NV	NV	NV	
4-Nitroaniline	ug/kg-dry	180 U	170 U	17 U	340 U	170 U	NV	NV	NV	
4-Nitrophenol	ug/kg-dry	180 U	170 U	17 U	340 U	170 U	NV	NV	NV	
Acenaphthene	ug/kg-dry	250	100	36	170 U	40 J	NV	NV	620	OSWER
Acenaphthylene	ug/kg-dry	31 J	170 U	17 U	170 U	170 U	NV	NV	NV	
Anthracene	ug/kg-dry	290	96	66	170 U	110	NV	57.2	--	
Benz(a)anthracene	ug/kg-dry	1000	390	250	140 J	240	31.7	108	--	
Benzidine	ug/kg-dry	360 U	340 U	34 U	340 U	170 U	NV	NV	1.7	ORNL
Benzo(a)pyrene	ug/kg-dry	1400	610	400	170 J	290	31.9	150	--	
Benzo(b)fluoranthene	ug/kg-dry	1700	670	490	190	330	NV	NV	27.2	ARCS TEC
Benzo(g,h,i)perylene	ug/kg-dry	700	260	160	78 J	150	NV	NV	170	Ontario LEL
Benzo(k)fluoranthene	ug/kg-dry	370	140	65	51 J	170 U	27.2	NV	--	
Benzoic Acid	ug/kg-dry	450 UJ	420 U	44 UJ	850 U	420 U	NV	NV	NV	
Benzyl Alcohol	ug/kg-dry	180 U	170 U	17 U	340 U	170 U	NV	NV	NV	
bis(2-Chloroethoxy)methane	ug/kg-dry	180 U	170 U	17 U	340 U	170 U	NV	NV	NV	
bis(2-Chloroethyl)ether	ug/kg-dry	180 U	170 U	17 U	340 U	170 U	NV	NV	NV	
bis(2-Chloroisopropyl)ether	ug/kg-dry	180 U	170 U	17 U	340 U	170 U	NV	NV	NV	
bis(2-Ethylhexyl)phthalate	ug/kg-dry	3800	2900 U	440	9500	2300 U	NV	NV	182	Revion IV
Butylbenzylphthalate	ug/kg-dry	180 U	170 U	27 U	340 U	170 U	NV	NV	11000	ORNL & OSWER
Carbazole	ug/kg-dry	190 J	79 J	27 J	850 U	71 J	NV	NV	NV	
Chrysene	ug/kg-dry	1000	410	270	170	300	26.83	166	--	
Dibenz(a,h)anthracene	ug/kg-dry	180	84 U	9 U	170 U	170 U	10	33	--	
Dibenzofuran	ug/kg-dry	62 J	27 J	9 J	340 U	83 U	NV	NV	420	ORNL
Diethylphthalate	ug/kg-dry	180 U	170 U	17 U	340 U	170 U	NV	NV	600	ORNL
Dimethylphthalate	ug/kg-dry	180 U	170 U	17 U	340 U	170 U	NV	NV	NV	
Di-n-butylphthalate	ug/kg-dry	910 U	840 U	87 U	1700 U	830 U	NV	NV	11000	ORNL & OSWER
Di-n-octylphthalate	ug/kg-dry	180 U	170 U	17 U	340 U	170 U	NV	NV	NV	
Fluoranthene	ug/kg-dry	2100	860	490	290	530	31.46	423	--	
Fluorene	ug/kg-dry	160	51 J	24	170 U	56 J	10	77.4	--	
Hexachlorobenzene	ug/kg-dry	180 U	170 U	17 U	340 UJ	170 U	NV	NV	NV	
Hexachlorobutadiene	ug/kg-dry	180 U	170 U	17 U	340 U	170 U	NV	NV	NV	
Hexachlorocyclopentadiene	ug/kg-dry	180 U	170 U	17 U	340 U	170 U	NV	NV	NV	
Hexachloroethane	ug/kg-dry	180 U	170 U	17 U	340 U	170 U	NV	NV	1000	ORNL
Indeno(1,2,3-cd)pyrene	ug/kg-dry	640	200	150	34 J	80 J	17.32	NV	--	
Isophorone	ug/kg-dry	180 U	170 U	17 U	340 U	170 U	NV	NV	NV	
Naphthalene	ug/kg-dry	27 J	84 U	6 J	170 U	170 U	NV	176	--	
Nitrobenzene	ug/kg-dry	180 U	170 U	17 U	340 U	170 U	NV	NV	NV	
N-nitrosodimethylamine	ug/kg-dry	180 U	170 U	17 U	340 UJ	170 U	NV	NV	NV	
N-nitroso-di-n-propylamine	ug/kg-dry	180 U	170 U	40 U	340 U	170 U	NV	NV	NV	
N-Nitrosodiphenylamine	ug/kg-dry	180 U	170 U	17 U	340 U	170 U	NV	NV	NV	
Pentachlorophenol (PCP)	ug/kg-dry	180 U	170 U	17 U	340 U	170 U	NV	NV	NV	
Phenanthrene	ug/kg-dry	1100	480	190	110 J	480	18.73	204	--	
Phenol	ug/kg-dry	180 U	170 U	17 U	340 U	170 U	NV	NV	31	ORNL
Pyrene	ug/kg-dry	1900	760	470	300	520	44.27	195	--	

Notes:

- Data presented herein reflect the concentrations, quantitation limits and qualifications as determined by the data validation process.  
The Data Validation Report is presented in Appendix C.  
Detections are in bold.  
Shaded concentrations are values above benchmark values.  
NV - No Value  
J - The associated numerical value is an estimate.  
U - The analyte was not detected above the reported sample quantitation limit.  
Elevated MRLs for diethylphthalate, di-n-butylphthalate, butylbenzylphthalate and bis(2-ethylhexyl)phthalate are a result of blank contamination.  
-- Not applicable since TEL or TEC are present.  
**Ecological Benchmark Values:**  
NOAA TEL - Screening Quick Reference Table Threshold Effects Level.  
TEC - Threshold Effect Concentration (MacDonald et al. 2000).  
WA State - Washington State Sediment Quality Criteria "no effects" level.  
ARCS TEC - Assessment and Remediation of Contaminated Sediment (ARCS) Project Threshold Effect Concentration.  
ORNL - Oak Ridge National Laboratory Secondary Chronic Values.  
OSWER - Office of Solid Waste and Emergency Response .  
Region IV - U.S. EPA Region IV Ecological Screening Value.



TABLE 4-14  
ANALYTICAL DATA SUMMARY  
BRADFORD ISLAND - SANDBLAST DRAIN SYSTEM - SEDIMENTS  
VOLATILE ORGANIC COMPOUNDS

Sample		010501SBMS01SS	010501SBMS02SS	010504SBDS24SS	Freshwater Sediment Ecological Benchmark Values				
Location		Catch Basin #1 (In catch basin)	Duplicate of 01SS	Catch Basin #2 (directly above catch basin)	NOAA TEL	TEC	Lowest of Other Reference Levels		
Date Collected		5/1/2001	5/1/2001	5/4/2001					
1,1,1,2-Tetrachloroethane	ug/kg-dry	0.51 U	0.48 U	0.98 U	NV	NV	1400	ORNL	
1,1,1-Trichloroethane (TCA)	ug/kg-dry	0.51 U	0.48 U	0.98 U	NV	NV	30	ORNL	
1,1,2,2-Tetrachloroethane	ug/kg-dry	0.51 U	0.48 U	0.98 U	NV	NV	940	OSWER	
1,1,2-Trichloroethane	ug/kg-dry	0.51 U	0.48 U	0.98 U	NV	NV	1200	ORNL	
1,1-Dichloroethane (1,1-DCA)	ug/kg-dry	0.51 U	0.48 U	0.98 U	NV	NV	27	ORNL	
1,1-Dichloroethene (1,1-DCE)	ug/kg-dry	0.51 U	0.48 U	0.98 U	NV	NV	31	ORNL	
1,1-Dichloropropene	ug/kg-dry	0.51 U	0.48 U	0.98 U	NV	NV	NV		
1,2,3-Trichlorobenzene	ug/kg-dry	0.51 U	0.48 U	0.98 U	NV	NV	NV		
1,2,3-Trichloropropane	ug/kg-dry	0.51 U	0.48 U	0.98 U	NV	NV	NV		
1,2,4-Trichlorobenzene	ug/kg-dry	0.51 U	0.48 U	0.98 U	NV	NV	9200	OSWER	
1,2,4-Trimethylbenzene	ug/kg-dry	0.4 J	0.48 U	0.98 U	NV	NV	NV		
1,2-Dibromo-3-chloropropane (DBCP)	ug/kg-dry	0.51 U	0.48 U	0.98 U	NV	NV	NV		
1,2-Dibromoethane (EDB)	ug/kg-dry	0.51 U	0.48 U	0.98 U	NV	NV	250	ORNL	
1,2-Dichlorobenzene	ug/kg-dry	0.51 U	0.48 U	0.98 U	NV	NV	330	ORNL	
1,2-Dichloroethane (EDC)	ug/kg-dry	0.51 U	0.48 U	0.98 U	NV	NV	NV		
1,2-Dichloropropane	ug/kg-dry	0.51 U	0.48 U	0.98 U	NV	NV	NV		
1,3,5-Trimethylbenzene	ug/kg-dry	0.29 J	0.48 U	0.98 U	NV	NV	NV		
1,3-Dichlorobenzene	ug/kg-dry	0.51 U	0.48 U	0.98 U	NV	NV	1700	ORNL & OSWER	
1,3-Dichloropropane	ug/kg-dry	0.51 U	0.48 U	0.98 U	NV	NV	NV		
1,4-Dichlorobenzene	ug/kg-dry	0.51 U	0.48 U	0.98 U	NV	NV	340	ORNL	
2,2-Dichloropropane	ug/kg-dry	0.51 U	0.48 U	0.98 U	NV	NV	NV		
2-Butanone	ug/kg-dry	10 J	7.5 J	25 J	NV	NV	270	ORNL	
2-Chlorotoluene	ug/kg-dry	0.51 U	0.48 U	0.98 U	NV	NV	NV		
2-Hexanone	ug/kg-dry	2.5 U	2.4 U	4.9 U	NV	NV	22	ORNL	
4-Chlorotoluene	ug/kg-dry	0.51 U	0.48 U	0.98 U	NV	NV	NV		
4-Isopropyltoluene	ug/kg-dry	9.5	4	2.5	NV	NV	NV		
4-Methyl-2-pentanone	ug/kg-dry	2.5 U	2.4 U	4.9 U	NV	NV	12	ORNL	
Acetone	ug/kg-dry	59 J	27 J	130 J	NV	NV	8.7	ORNL	
Benzene	ug/kg-dry	0.94	1.2	0.58 J	NV	NV	160	ORNL	
Bromobenzene	ug/kg-dry	0.51 U	0.48 U	0.98 U	NV	NV	NV		
Bromochloromethane	ug/kg-dry	0.51 U	0.48 U	0.98 U	NV	NV	NV		
Bromodichloromethane	ug/kg-dry	0.51 U	0.48 U	0.98 U	NV	NV	NV		
Bromoform	ug/kg-dry	0.51 U	0.48 U	0.98 U	NV	NV	NV		
Bromomethane	ug/kg-dry	0.86 U	0.76 U	1.8 U	NV	NV	NV		
Carbon disulfide	ug/kg-dry	1.5	1.6	5.6	NV	NV	0.85	ORNL	
Carbon Tetrachloride	ug/kg-dry	0.51 U	0.48 U	0.98 U	NV	NV	47	ORNL	
Chlorobenzene	ug/kg-dry	0.51 U	0.48 U	0.98 U	NV	NV	410	ORNL	
Chloroethane	ug/kg-dry	0.51 U	0.48 U	0.98 U	NV	NV	NV		
Chloroform	ug/kg-dry	0.51 U	0.48 U	0.98 U	NV	NV	22	ORNL	
Chloromethane	ug/kg-dry	0.51 U	0.48 U	0.98 U	NV	NV	NV		
cis-1,2-Dichloroethene	ug/kg-dry	0.51 U	0.48 U	0.98 U	NV	NV	NV		
cis-1,3-Dichloropropene	ug/kg-dry	0.51 U	0.48 U	0.98 U	NV	NV	NV		
Dibromochloromethane	ug/kg-dry	0.51 U	0.48 U	0.98 U	NV	NV	NV		
Dibromomethane	ug/kg-dry	0.51 U	0.48 U	0.98 U	NV	NV	NV		
Dichlorodifluoromethane (CFC 12)	ug/kg-dry	0.51 U	0.48 U	0.98 U	NV	NV	NV		
Ethylbenzene	ug/kg-dry	0.41 J	0.4 J	0.98 U	NV	NV	89	ORNL	
Hexachlorobutadiene	ug/kg-dry	0.51 U	0.48 U	0.98 U	NV	NV	NV		
Isopropylbenzene (Cumene)	ug/kg-dry	0.51 U	0.48 U	0.98 U	NV	NV	NV		
m,p-Xylenes	ug/kg-dry	0.56 J	0.52 J	2 U	NV	NV	25	OSWER	
Methylene chloride	ug/kg-dry	0.51 U	0.48 U	0.98 U	NV	NV	370	ORNL	
Naphthalene	ug/kg-dry	0.7	0.27 J	0.98 U	14.65	176	--		
n-Butylbenzene	ug/kg-dry	0.51 U	0.48 U	0.98 U	NV	NV	NV		
n-Propylbenzene	ug/kg-dry	0.51 U	0.48 U	0.98 U	NV	NV	NV		
o-Xylene	ug/kg-dry	0.3 J	0.26 J	0.98 U	NV	NV	25	OSWER	
sec-Butylbenzene	ug/kg-dry	0.51 U	0.48 U	0.98 U	NV	NV	NV		
Styrene	ug/kg-dry	0.51 U	0.48 U	0.98 U	NV	NV	NV		
tert-Butylbenzene	ug/kg-dry	0.51 U	0.48 U	0.98 U	NV	NV	NV		
Tetrachloroethene (PCE)	ug/kg-dry	0.31 J	0.48 U	0.98 U	NV	NV	410	ORNL	
Toluene	ug/kg-dry	24	9.5	53	NV	NV	50	ORNL	
trans-1,2-Dichloroethene	ug/kg-dry	0.51 U	0.48 U	0.98 U	NV	NV	NV		
trans-1,3-Dichloropropene	ug/kg-dry	0.51 U	0.48 U	0.98 U	NV	NV	NV		
Trichloroethene (TCE)	ug/kg-dry	0.51 U	0.48 U	0.98 U	NV	NV	220	ORNL	
Trichlorofluoromethane	ug/kg-dry	0.51 U	0.48 U	0.98 U	NV	NV	NV		
Vinyl acetate	ug/kg-dry	2.5 U	2.4 U	4.9 U	NV	NV	0.84	ORNL	
Vinyl chloride	ug/kg-dry	0.51 U	0.48 U	0.98 U	NV	NV	NV		

**Notes:**  
Data presented herein reflect the concentrations, quantitation limits and qualifications as determined by the data validation process. The Data Validation Report is presented in Appendix C.  
Detections are in bold.  
Shaded concentrations are values above benchmark values.  
NV = No Value  
J - The associated numerical value is an estimate.  
U - The analyte was not detected above the reported sample quantitation limit.  
-- Not applicable since TEL or TEC are present.  
**Ecological Benchmark Values:**  
NOAA TEL - Screening Quick Reference Table Threshold Effects Level.  
TEC - Threshold Effect Concentration (MacDonald et al. 2000).  
ORNL - Oak Ridge National Laboratory Secondary Chronic Values.  
OSWER - Office of Solid Waste and Emergency Response .

**TABLE 4-16**  
**ANALYTICAL DATA SUMMARY**  
**BRADFORD ISLAND - SANDBLAST DRAIN SYSTEM - SEDIMENTS**  
**TOTAL PETROLEUM HYDROCARBONS**

Sample		010501SBMS01SS	010501SBMS02SS	010503SBDS19SS	010504SBDS24SS	010503SBDS18SS
Location		Catch Basin #1 (In catch basin)	Duplicate of 01SS	Drain outfall #1	Catch Basin #2 (directly above catch basin)	Drain outfall #2
Date Collected		5/1/2001	5/1/2001	5/3/2001	5/4/2001	5/3/2001
<b>NWTPH-HCID</b>						
<b>Diesel (&gt;nC12-nC24)</b>	mg/kg-dry	>68 X2	>61 X2	<64	<120	>63 X2
<b>Gasoline (Toluene-nC12)</b>	mg/kg-dry	<27	<24	<26	<48	<25
<b>Motor Oil (&gt;nC24-nC32)</b>	mg/kg-dry	<b>&gt;140</b> X2	<b>&gt;120</b> X2	<b>&gt;130</b> X2	<b>&gt;240</b>	<b>&gt;130</b> X2
<b>NWTPH-Dx</b>						
<b>2 Diesel</b>	mg/kg-dry	130 X2	95 X2	40 X2	180 X1	40 X1
<b>Motor Oil</b>	mg/kg-dry	<b>600</b>	<b>410</b>	170 X2	<b>1400</b>	<b>410</b>

**Notes:**

Data presented herein reflect the concentrations, quantitation limits and qualifications as determined by the data validation process. The Data Validation Report is presented in Appendix C.

Detections are in bold.

X1 = the pattern suggests that the contamination is diesel with overlap from the motor oil range.

X2 = the elution patterns for the contamination detected do not appear to be typical diesel or motor oil product.

**TABLE 4-17**  
**ANALYTICAL DATA SUMMARY**  
**BRADFORD ISLAND - SANDBLAST DRAIN SYSTEM - SEDIMENTS**  
**BUTYLTINS**

Sample		010501SBMS01SS	010501SBMS02SS	010503SBDS19SS	010503SBDS20SS	010504SBDS24SS	010503SBDS18SS	Sediment Ecological Benchmark Values	
Location		Catch Basin #1 (In catch basin)	Duplicate of 01SS	Drain outfall #1	Duplicate of 19SS	Catch Basin #2 (directly above catch basin)	Drain outfall #2	NOAA TEL	Puget Sound SL
Date Collected		5/1/2001	5/1/2001	5/3/2001	5/3/2001	5/4/2001	5/3/2001		
<b>BULK SEDIMENT</b>									
Dibutyltin	ug/kg-dry	2.7 U	2.6 U	9.6	NA	310	2 J	NV	NV
Monobutyltin	ug/kg-dry	3.6 U	3.5 U	6.1	NA	110	3.4 U	NV	NV
Tetrabutyltin	ug/kg-dry	1.8 U	1.7 U	3 U	NA	30 U	1.7 U	NV	NV
Tributyltin	ug/kg-dry	3.6 U	3.5 U	15	NA	680	12	NV	73
<b>PORE WATER</b>									
								NOAA TEL	Puget Sound NEL
Dibutyltin	ug/L	NA	NA	0.02 U	0.02 U	NA	0.082	NV	NV
Monobutyltin	ug/L	NA	NA	0.02 U	0.02 U	NA	0.57	NV	NV
Tetrabutyltin	ug/L	NA	NA	0.02 U	0.02 U	NA	0.04 U	NV	NV
Tributyltin	ug/L	NA	NA	0.02 U	0.02 U	NA	0.04 U	0.063	0.05

**Notes:**

Data presented herein reflect the concentrations, quantitation limits and qualifications as determined by the data validation process. The Data Validation Report is presented in Appendix C.

Detections are in bold.

Shaded concentrations are values above benchmark values.

J - The associated numerical value is an estimate

U - The analyte was not detected above the reported sample quantitation limit.

**Ecological Benchmark Values:**

NOAA TEL - NOAA Screening Quick Reference Table Threshold Effects Level.

Puget Sound SL/NEL - Puget Sound Tributyltin Screening Level/No Adverse Effects Level.

NV - No Value

**TABLE 4-18**  
**SUMMARY AND DESCRIPTION OF BENCHMARK VALUES**

	<b>Benchmark Value</b>	<b>Applicability of Benchmark Value</b>
NOAA TEL	Screening Quick Reference Table Threshold Effects Level.	Ensures, with a high degree of confidence, that any contaminant sources eliminated from future consideration pose no potential threat. It does not necessarily predict toxicity.
TEC	Threshold Effect Concentration (MacDonald et al. 2000).	TECs predict the absence of sediment toxicity.
ISQGs	Canadian Sediment Quality Guidelines for the Protection of Aquatic Life, Interim freshwater sediment quality guidelines (ISQGs).	ISQGs represent concentrations of individual chemicals below which adverse biological effects are not expected. They are developed with the intention to be conservative, national benchmarks to protect and sustain important resource uses.
Ontario LEL	Ontario Ministry of the Environment Lowest Effect Level.	A level of contamination which has no effect on the majority of the sediment-dwelling organisms. The sediment is clean to marginally polluted.
ARCS	Assessment and Remediation of Contaminated Sediment (ARCS) Project Threshold Effect Concentration.	TECs are conservative screening values, below which effects are rarely expected to occur.
ORNL	Oak Ridge National Laboratory Secondary Chronic Values.	Secondary chronic values are intended to be conservative predictors of effects.
OSWER	Office of Solid Waste and Emergency Response .	Contaminant concentrations above which there is sufficient concern regarding adverse ecological effects to warrant further site investigation.
Region IV	U.S. EPA Region IV Ecological Screening Value.	Screening values are based on contaminant levels associated with a low probability of unacceptable risks to ecological receptors.
WA State	Washington State Sediment Quality Criteria "no effects" level.	Marine sediment quality that will result in no adverse effects, including no acute or chronic adverse effects on biological resources and no significant health risk to humans.
NY LEL	New York State Sediment Lowest Effect Level for Metals.	The LEL indicates a level of sediment contamination that can be tolerated by the majority of benthic organisms, but still causes toxicity to a few species.
Puget Sound NEL	Puget Sound Tributyltin No Adverse Effect Level.	The NEL corresponds to a no adverse effects level that would protect approximately 95% of the Puget Sound species that have been tested.
<b>Surface Water</b>		
WQC	Ambient Water Quality Criterion Continuous Concentration	An estimate of the highest concentration of a material in surface water to which an aquatic community can be exposed indefinitely without resulting in an unacceptable effect.

**TABLE 4-19**  
**Compounds for which Sediment Benchmark Values were not Available**

<b>In Water Samples</b>		<b>Drain Samples</b>		
<b>SVOCs</b>	<b>Herbicides</b>	<b>VOCs</b>	<b>SVOCs</b>	<b>Metals</b>
2,4,5-Trichlorophenol	2,4,5-T	1,1-Dichloropropene	2,4,5-Trichlorophenol	Barium*
2,4,6-Trichlorophenol	2,4-D	1,2,3-Trichlorobenzene	2,4,6-Trichlorophenol	Beryllium*
2,4-Dichlorophenol	2,4-DB	1,2,3-Trichloropropane	2,4-Dichlorophenol	Calcium*
2,4-Dimethylphenol	4-Nitrophenol	1,2,4-Trimethylbenzene*	2,4-Dimethylphenol	Cobalt*
2,4-Dinitriphenol	Dalapon	1,2-Dibromo-3-chloropropane (DBCP)	2,4-Dinitriphenol	Magnesium*
2,4-Dinitrotoluene	Dicamba	1,2-Dichloroethane (EDC)	2,4-Dinitrotoluene	Selenium*
2,6-Dinitrirotoluene*	Dichloroprop	1,2-Dichloropropane	2,6-Dinitrirotoluene*	Thallium*
2-Choronaphthlanene	Dinoseb	1,3,5-Trimethylbenzne	2-Choronaphthlanene	Potassium*
2-Chlorophenol	MCPA	1,3-Dichloropropane	2-Chlorophenol	Vanadium*
2-Nitroaniline	MCPP	2,2-Dichloropropane	2-Nitroaniline	<b>Butyltins</b>
2-Nitrophenol	Pentachlorophenol (PCP)	2-Chlorotoluene	2-Nitrophenol	Monobutyltin (bulk and pore)*
3,3'-Dipchlorobenzidine	Silvex (2,4,5-TP)	4-Chlorotoluene	3,3'-Dipchlorobenzidine	Dibutyltin (bulk and pore)*
3-Nitroaniline	Pesticides	4-Isopropyltoluene*	3-Nitroaniline	Tetrabutyltin (bulk and pore)
4,6-Dinitro-2-methylphenol	Endosulfan sulfate	Bromobenzene	4,6-Dinitro-2-methylphenol	<b>NWTPH</b>
4-Chloro-3-methylphenol	Endrin aldehyde	Bromochloromethane	4-Chloro-3-methylphenol	Diesel range hydrocarbons*
4-Chloroaniline	Endrin ketone	Bromodichloromethane	4-Chloroaniline	
4-Chlorophenylphenylether	<b>Metals</b>	Bromoform	4-Chlorophenylphenylether	
4-Nitroaniline	Barium*	Bromomethane*	4-Nitroaniline	
4-Nitrophenol	Beryllium*	Chloroethane	4-Nitrophenol	
Acenaphthylene	Calcium*	Chloromethane	Acenaphthylene	
Benzoic Acid	Cobalt*	cis-1,2-Dichloroethene	Benzoic Acid	
Benzyl Alcohol	Magnesium*	cis-1,3-Dichloropropene	Benzyl Alcohol	
bis(2-Chloroethoxy)methane	Selenium*	Dibromochloromethane	bis(2-Chloroethoxy)methane	
bis(2-Chloroethyl)ether	Thallium*	Dibromomethane	bis(2-Chloroethyl)ether	
bis(2-Chloroisopropyl)ether	Potassium*	Dichlorodifluoromethane (CFC 12)	bis(2-Chloroisopropyl)ether	
Carbazole	Vanadium*	Isopropylbenzene (Cumene)	Carbazole	
Dimethylphthalate		n-Butylbenzene	Dimethylphthalate	
Di-n-octylphthatalate		n-Propylbenzene	Di-n-octylphthatalate	
Hexachlorobenzene		sec-Butylbenzene	Hexachlorobenzene	
Hexachlorobutadiene		Styrene	Hexachlorobutadiene	
Hexachlorocyclopentadiene		tert-Butylbenzene	Hexachlorocyclopentadiene	
Isophorone		trans-1,2-Dichloroethene	Isophorone	
Nitrobenzene		trans-1,3-Dichloropropene	Nitrobenzene	
N-nitrosodimethylamine		Trichlorofluoromethane	N-nitrosodimethylamine	
N-nitroso-di-n-propylamine		Vinyl chloride	N-nitroso-di-n-propylamine	
N-nitrosodiphenylamine		<b>Hydrocarbons</b>	N-nitrosodiphenylamine	
Pentachlorophenol (PCP)		Diesel range organics	Pentachlorophenol (PCP)	
		Motor oil range organics		

\*Compound was detected at the site.

**TABLE 4-20**  
**ANALYTICAL DATA SUMMARY**  
**BRADFORD ISLAND LANDFILL - IN WATER RESULTS - WASTE CHARACTERIZATION**  
**POLYCHLORINATED BIPHENYLS**

Sample ID		20-11-5	20-11-4	20-11-3	20-11-7a
Type of Electrical Equipment		Interteen Capacitor	Coupling Capacitor	Lightening Ballast	Felt on end of Fuse
Date Collected		11/7/2001	11/7/2001	11/7/2001	11/7/2001
Aroclor 1242	ug/Kg	500000 U	500000 U	500000 U	500000 U
Aroclor 1248	ug/Kg	500000 U	500000 U	500000 U	500000 U
Aroclor 1254	ug/Kg	>200,000,0000 J	1990	258000	6350
Aroclor 1260	ug/Kg	500000 U	500000 U	500000 U	500000 U

**Notes:**

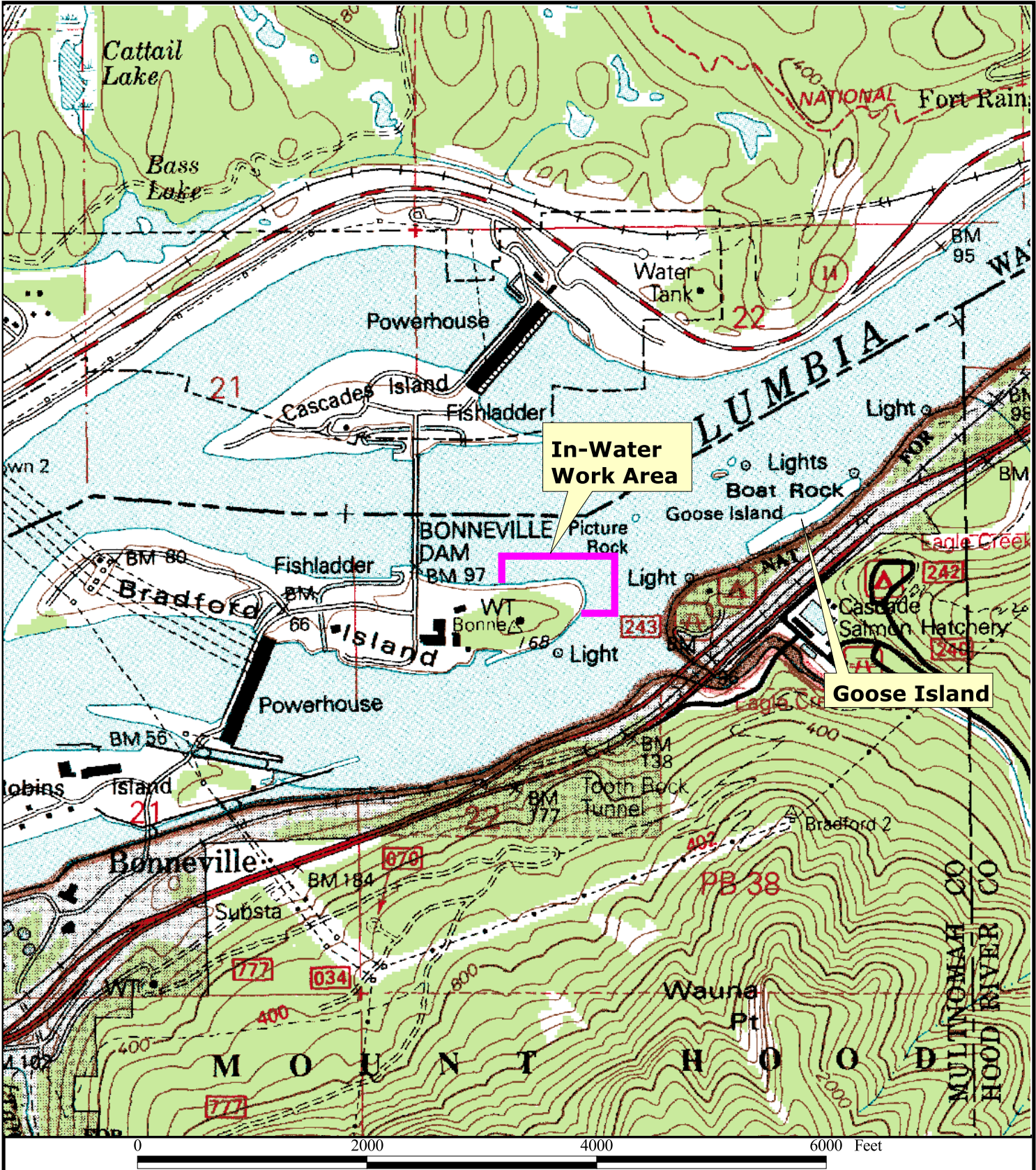
U - The analyte was not detected above the reported sample quantitation limit.

J - The associated numerical value is an estimate.

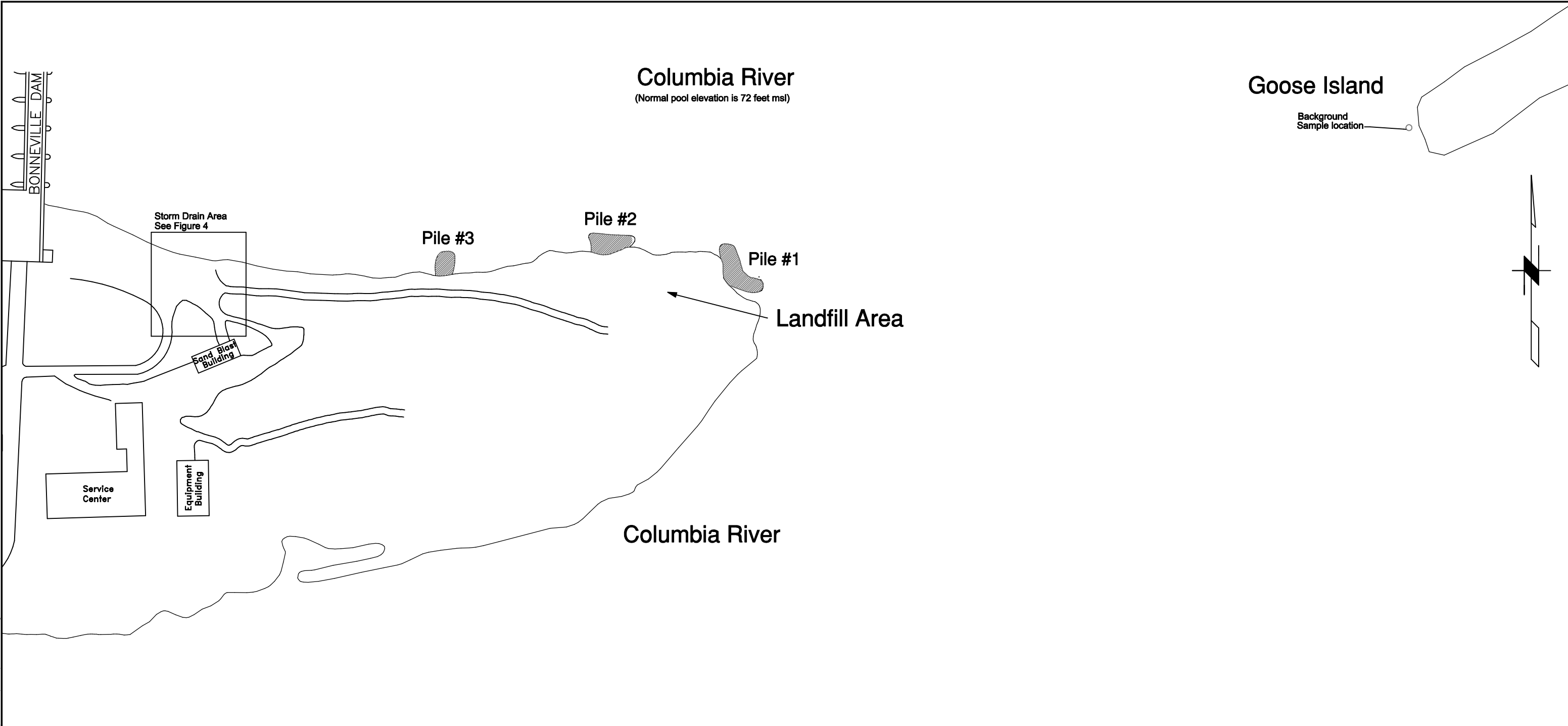
# FIGURES

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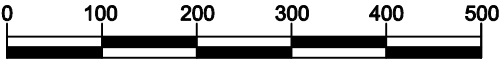

Project Number: 52-00080001.07 00001  
 Date: January 2, 2002  
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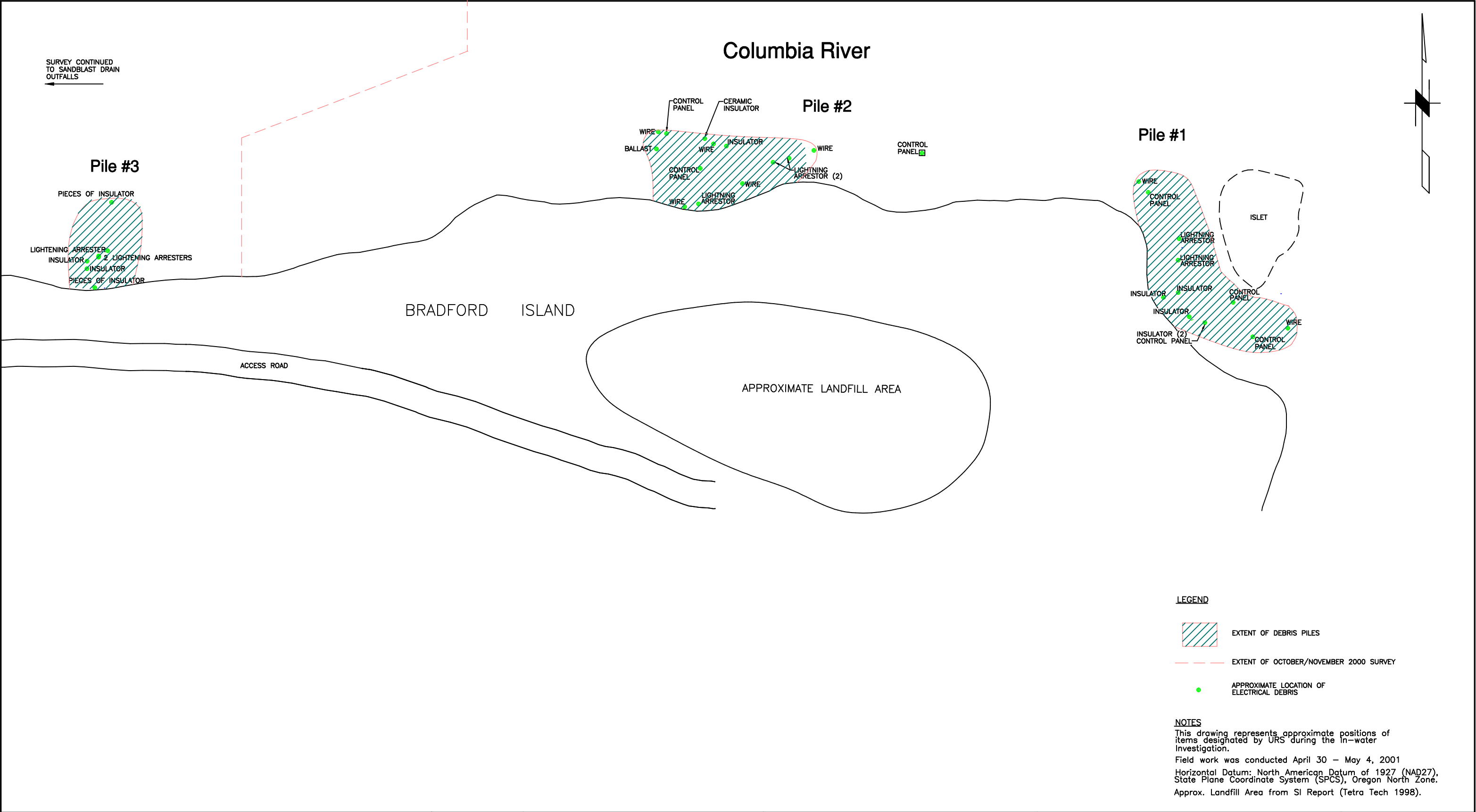
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**LEGEND**

- BACKGROUND SEDIMENT, WATER COLUMN, SPMD, CLAM & CRAYFISH TISSUE SAMPLE LOCATION

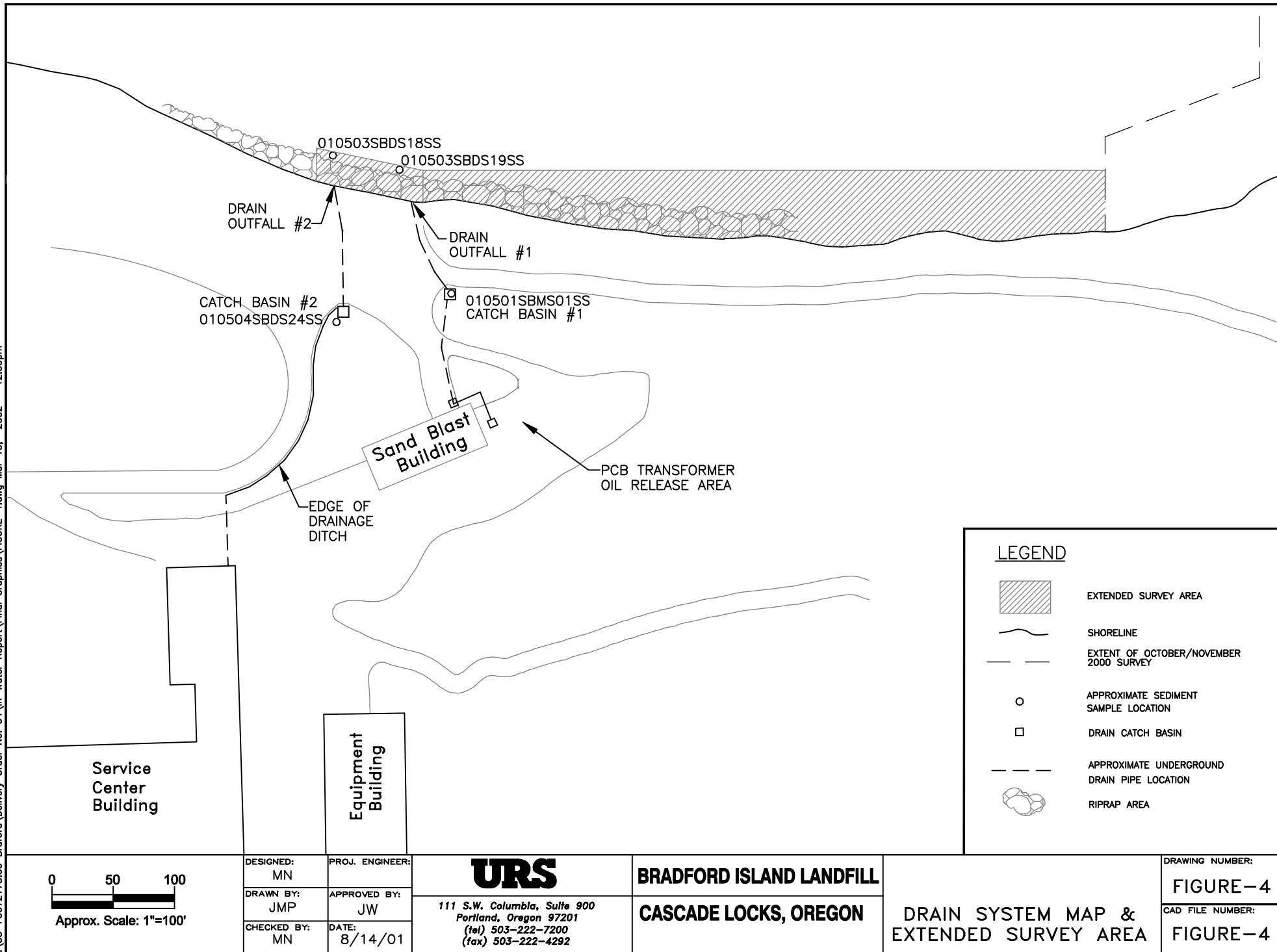
 <p>Approx. Scale</p>	DESIGNED: MN	PROJ. ENGINEER:	  111 S.W. Columbia, Suite 900 Portland, Oregon 97201 (tel) 503-222-7200 (fax) 503-222-4292	BRADFORD ISLAND LANDFILL	SITE MAP	DRAWING NUMBER:
	DRAWN BY: JMP	APPROVED BY: JW				FIGURE-2
	CHECKED BY: MN	DATE: 8/14/01		CASCADE LOCKS, OREGON		CAD FILE NUMBER: FIGURE-2

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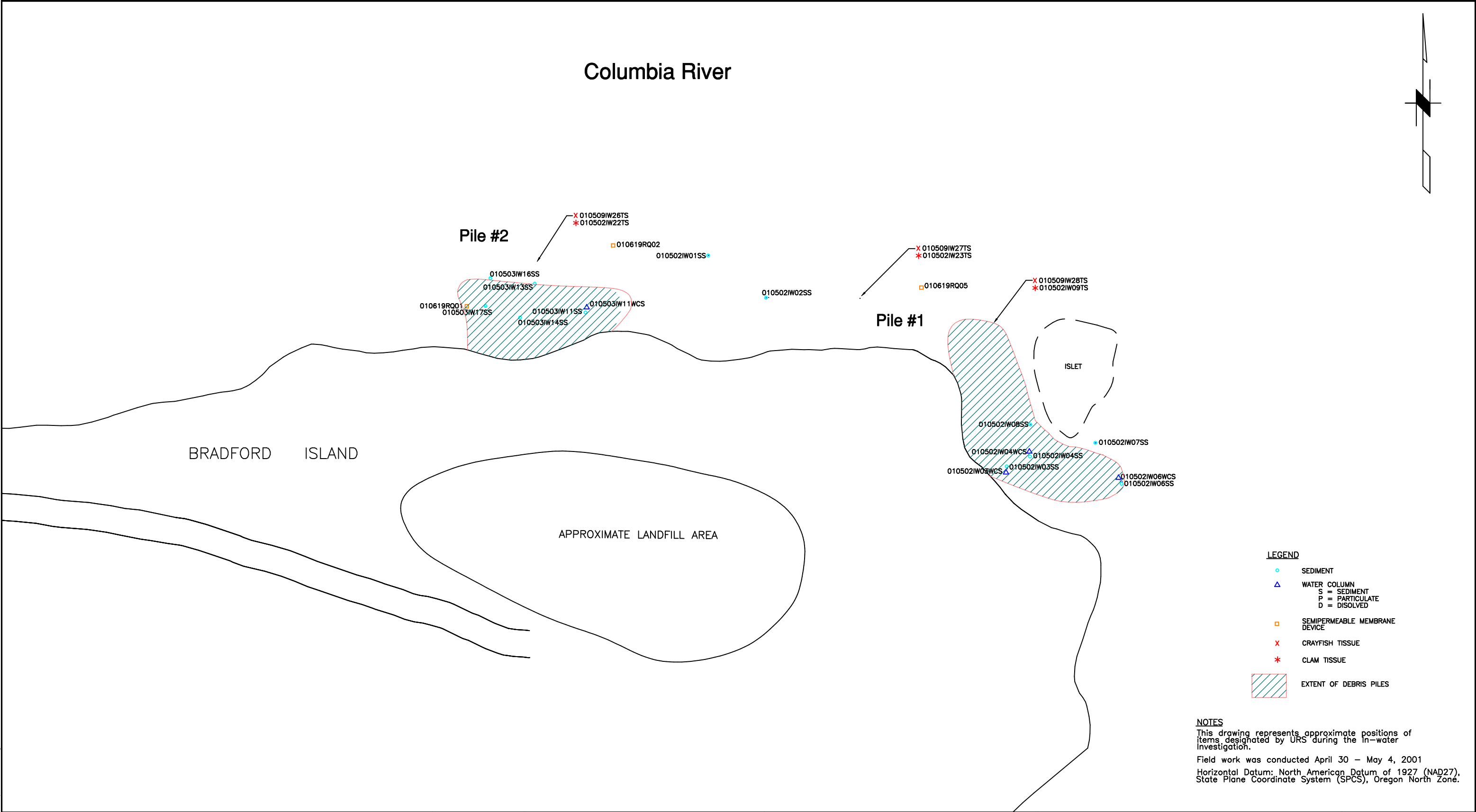


<p>APPROX. SCALE: 1" = 50'</p>	DESIGNED: MN	PROJ. ENGINEER:	<p>111 S.W. Columbia, Suite 900 Portland, Oregon 97201 (tel) 503-222-7200 (fax) 503-222-4292</p>	<b>BRADFORD ISLAND LANDFILL</b>  <b>CASCADE LOCKS, OREGON</b>	<b>DEBRIS LOCATION MAP</b>	DRAWING NUMBER: <b>FIGURE-3</b>
	DRAWN BY: JMP	APPROVED BY: JW				CAD FILE NUMBER:
	CHECKED BY: MN	DATE: 8/14/01				<b>FIGURE-3</b>

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DESIGNED: MN	PROJ. ENGINEER:
DRAWN BY: JMP	APPROVED BY: JW
CHECKED BY: MN	DATE: 8/14/01

**URS**

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 Portland, Oregon 97201  
 (tel) 503-222-7200  
 (fax) 503-222-4292

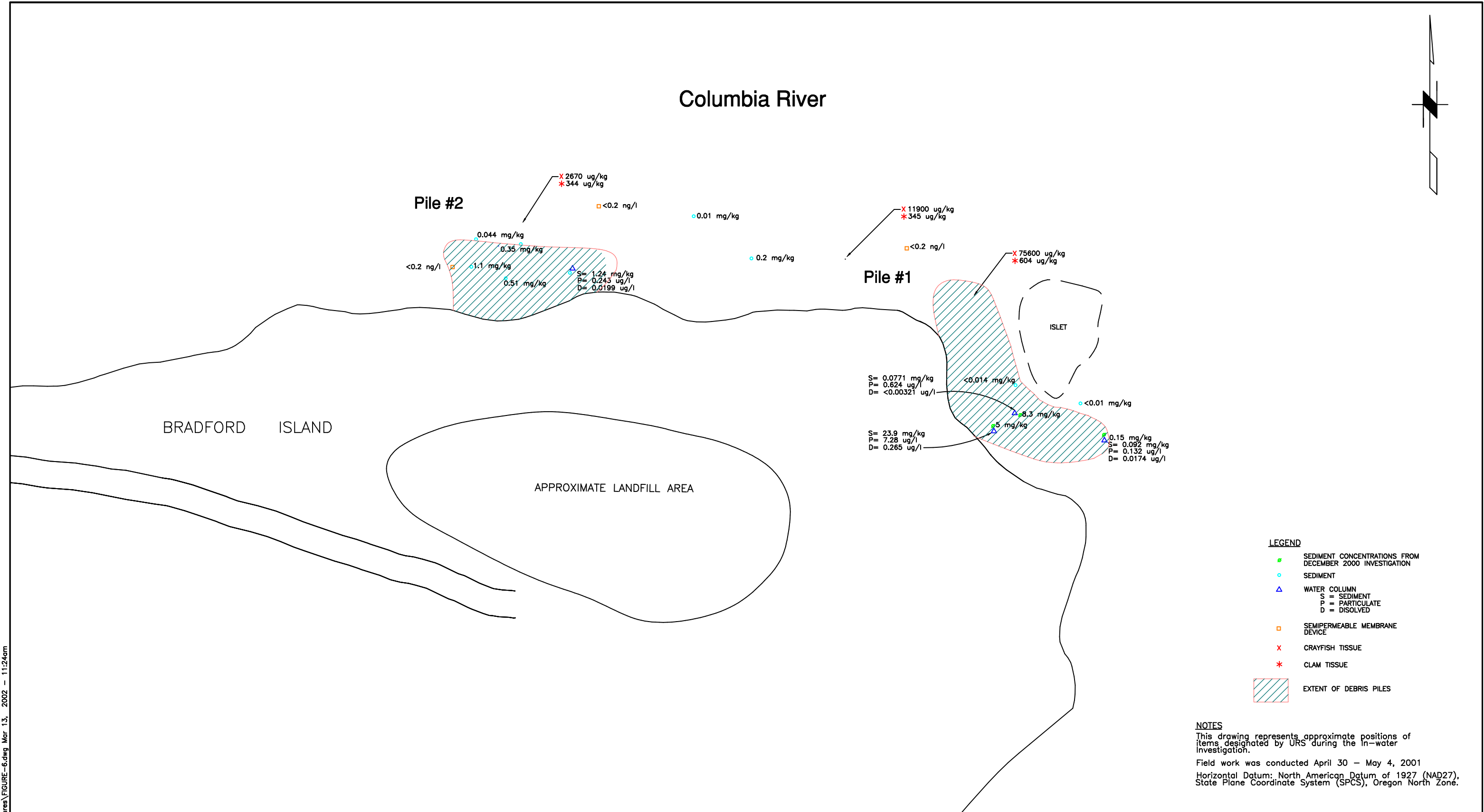
**BRADFORD ISLAND LANDFILL**

**CASCADE LOCKS, OREGON**

**SAMPLE LOCATION  
MAP**

DRAWING NUMBER: <b>FIGURE-5</b>
CAD FILE NUMBER: <b>FIGURE-5</b>

S:\PUBLIC\Novak\Bradford-figures\FIGURE-6.dwg Mar 13, 2002 - 11:24am



DESIGNED: MN	PROJ. ENGINEER:
DRAWN BY: JMP	APPROVED BY: JW
CHECKED BY: MN	DATE: 8/14/01

<b>URS</b>	
	111 S.W. Columbia, Suite 900 Portland, Oregon 97201 (tel) 503-222-7200 (fax) 503-222-4292

<b>BRADFORD ISLAND LANDFILL</b>
<b>CASCADE LOCKS, OREGON</b>

<b>PCB (AROCOR 1254) CONCENTRATION MAP</b>
--

DRAWING NUMBER: <b>FIGURE-6</b>
CAD FILE NUMBER: <b>FIGURE-6</b>



# FIELD SAMPLING DATA SHEET

Sample Type: <u>Sediment</u>	Sample Number: <u>010501 SBDS01SS</u>	Date: <u>5/1/01</u>
Project: <u>Bradford Island</u>	Project Number: <u>52-00080001.00</u>	Task: <u>00004</u>
Weather Conditions: <u>Overcast/rainy</u>	Sample Matrix: <u>Sediment</u>	
		Comments: _____

<p>PID/FID Backgd: <u>N/A / N/A</u> ppm</p> <p>Head Space <u>N/A / N/A</u> ppm</p> <p>P.I.D/FID Calibration Standard: _____</p> <p>P.I.D./FID Calibration Date : _____</p> <p>Soil Type: (USCS) <u>GP</u></p> <p>Description: <u>Poorly graded sandy gravel, brown-gray, saturated (see field notebook for description).</u></p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>Decontamination Method: <u>N/A – Dedicated steel spoon, gloves</u></p> <p>_____</p> <p>_____</p>	<p>Sample Location: <u>Sandblast Building</u></p> <p><u>Drain System #1 (easternmost drain)</u></p> <p>Sample Depth: _____</p> <p>Sample Time: <u>1730</u></p> <p>Number of Sample Containers: <u>9</u></p> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th colspan="2" style="text-align: center;">Analyses</th> </tr> </thead> <tbody> <tr> <td style="width: 50%;">1. VOC</td> <td style="width: 50%;">2. PCBs</td> </tr> <tr> <td>3. Butyltins</td> <td>4. TOC</td> </tr> <tr> <td>5. Metals</td> <td>6. NWTPH-HCID</td> </tr> <tr> <td>7. SVOCs</td> <td>8.</td> </tr> </tbody> </table> <p>Other Field Measurements: _____</p> <p>_____</p> <p>QA/QC samples: <u>Duplicate, QA, MS/MSD**</u></p> <p>Sampling Method: <u>Grab</u></p> <p>Grab: <u>X</u> Composite: _____</p> <p>Sampler (s): <u>B.P. McNamara/M. Novak</u></p> <p>Signature: _____</p>	Analyses		1. VOC	2. PCBs	3. Butyltins	4. TOC	5. Metals	6. NWTPH-HCID	7. SVOCs	8.
Analyses											
1. VOC	2. PCBs										
3. Butyltins	4. TOC										
5. Metals	6. NWTPH-HCID										
7. SVOCs	8.										

<p><b>**Collected primary &amp; QA (both with the same label identification)</b></p> <p>Collected duplicate sample #010501SBMS02SS</p> <p>_____</p> <p>Invertebrate Sample Observations: <u>N/A</u></p> <p>_____</p> <p>_____</p> <p>General Comments: <u>Sediment collected from catchbasin. Approximately 6" standing water. Had to remove catch basin lid and sediment blanket to collect the sample from within the catchbasin.</u></p>
---



## FIELD SAMPLING DATA SHEET

Sample Type: <u>Sediment</u>	Sample Number: <u>010501 SBDS03SS</u>	Date: <u>5/1/01</u>
Project: <u>Bradford Island</u>	Project Number: <u>52-00080001.00</u>	Task: <u>00004</u>
Weather Conditions: <u>Overcast/rainy</u>	Sample Matrix: <u>Sediment</u>	
		Comments: <u>Poor Sample – Mostly gravel</u>

<p>PID/FID Backgd: <u>N/A / N/A</u> ppm</p> <p>Head Space <u>N/A / N/A</u> ppm</p> <p>P.I.D/FID Calibration Standard: <u>N/A</u></p> <p>P.I.D./FID Calibration Date : <u>N/A</u></p> <p>Soil Type: (USCS) <u>GP-GW</u></p> <p>Description: <u>Poorly graded to well graded gravel (90%) with some sand (10%), poorly graded, brown-gray, saturated, very little fines.</u></p> <p>Decontamination Method: <u>None – Dedicated stainless steel spoon, gloves.</u></p>	<p>Sample Location: <u>Sandblast Building</u></p> <p><u>Drain System – Drain #2 (westernmost drain)</u></p> <p>Sample Depth: _____</p> <p>Sample Time: <u>1800</u></p> <p>Number of Sample Containers: <u>2</u></p> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th colspan="2" style="text-align: center;">Analyses</th> </tr> </thead> <tbody> <tr> <td style="width: 50%;">1. VOC</td> <td style="width: 50%;">2. PCBs</td> </tr> <tr> <td>3. Butyltins</td> <td>4. TOC</td> </tr> <tr> <td>5. Metals</td> <td>6. NWTPH-HCID</td> </tr> <tr> <td>7. SVOCs</td> <td>8.</td> </tr> </tbody> </table> <p>Other Field Measurements: <u>N/A</u></p> <p>QA/QC samples: <u>None</u></p> <p>Sampling Method: <u>Grab</u></p> <p>Grab: <u>X</u> Composite: _____</p> <p>Sampler (s): <u>B.P. McNamara/M. Novak</u></p> <p>Signature: _____</p>	Analyses		1. VOC	2. PCBs	3. Butyltins	4. TOC	5. Metals	6. NWTPH-HCID	7. SVOCs	8.
Analyses											
1. VOC	2. PCBs										
3. Butyltins	4. TOC										
5. Metals	6. NWTPH-HCID										
7. SVOCs	8.										

<p>Water Quality Observations: <u>N/A</u></p> <p>Invertebrate Sample Observations: <u>N/A</u></p>	<p>General Comments: <u>Poor sample due to prevalence of gravel and pebbles. Could only fill 2 out of 3 sample containers. Sample mainly consisted of gravel that fell through catchbasin grate (no sediment blanket present). Sample not analyzed.</u></p>
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## FIELD SAMPLING DATA SHEET

Sample Type: <u>Sediment</u>	Sample Number: <u>010502IW01SS</u>	Date: <u>5/2/01</u>
Project: <u>Bradford Island</u>	Project Number: <u>52-00080001.00</u>	Task: <u>00004</u>
Weather Conditions: <u>Overcast - 55°F</u>	Sample Matrix: <u>Sediment</u>	
		Comments: _____

<p>PID/FID Backgd: <u>N/A / N/A</u> ppm</p> <p>Head Space <u>N/A / N/A</u> ppm</p> <p>P.I.D/FID Calibration Standard: <u>N/A</u></p> <p>P.I.D./FID Calibration Date : <u>N/A</u></p> <p>Soil Type: (USCS) <u>GP-SP</u></p> <p>Description: <u>Poorly graded gravel and gravelly sand (gravel 80%, sand 15%, cobbles 5%); rounded cobbles up to 4" in diameter. Sand was brown-dark gray, saturated. Very little fines present.</u></p> <p>Decontamination Method: <u>None – Dedicated stainless steel spoon</u></p>	<p>Sample Location: <u>Pile #2 - East Perimeter of pile</u></p> <p>Sample Depth: <u>~ 35' below surface of river</u></p> <p>Sample Time: <u>1040</u></p> <p>Number of Sample Containers: <u>jar, bag (grain size)</u></p> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th colspan="2" style="text-align: center;">Analyses</th> </tr> </thead> <tbody> <tr> <td style="width: 50%;">1. 8082</td> <td style="width: 50%;">2. Metals</td> </tr> <tr> <td>3. 8081</td> <td>4. NWTPH-HCID</td> </tr> <tr> <td>5. 8151</td> <td>6. 9060</td> </tr> <tr> <td>7. 8270</td> <td>8.</td> </tr> </tbody> </table> <p>Other Field Measurements: <u>N/A</u></p> <p>QA/QC samples: _____</p> <p>Sampling Method: <u>Diver collected sample with spoon.</u></p> <p>Grab: <u>X</u> Composite: <u>N/A</u></p> <p>Sampler (s): <u>R. La Plant, B.P. McNamara, M. Novak</u></p> <p>Signature: _____</p>	Analyses		1. 8082	2. Metals	3. 8081	4. NWTPH-HCID	5. 8151	6. 9060	7. 8270	8.
Analyses											
1. 8082	2. Metals										
3. 8081	4. NWTPH-HCID										
5. 8151	6. 9060										
7. 8270	8.										

<p>Water Quality Observations: <u>N/A</u></p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>Invertebrate Sample Observations: <u>N/A</u></p> <p>_____</p> <p>General Comments: <u>Diver proceeded to river bottom from the boat with sample containers and spoon. Diver placed sediment into containers and returned to boat with the collected sample.</u></p> <p>_____</p> <p>_____</p>	
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## FIELD SAMPLING DATA SHEET

Sample Type: <u>Sediment</u>	Sample Number: <u>010502IW02SS</u>	Date: <u>5/2/01</u>
Project: <u>Bradford Island</u>	Project Number: <u>52-00080001.00</u>	Task: <u>00004</u>
Weather Conditions: <u>Partly Sunny - 55°F</u>	Sample Matrix: <u>Sediment</u>	
		Comments: _____

<p>PID/FID Backgd: <u>N/A / N/A</u> ppm</p> <p>Head Space <u>N/A / N/A</u> ppm</p> <p>P.I.D/FID Calibration Standard: <u>N/A</u></p> <p>P.I.D/FID Calibration Date : <u>N/A</u></p> <p>Soil Type: (USCS) <u>GP-SP</u></p> <p>Description: <u>Poorly graded gravel and gravelly sand (gravel 80%, sand 15%, cobbles 5%) Rounded cobbles up to 4" in diameter. Sand was brown-dark gray, saturated. Very little fines present.</u></p> <p>Decontamination Method: <u>None – Dedicated stainless steel spoon.</u></p>	<p>Sample Location: <u>Pile #2</u></p> <p>Sample Depth: <u>40' below surface of river</u></p> <p>Sample Time: <u>1030</u></p> <p>Number of Sample Containers: <u>2 glass jars</u></p> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th colspan="2" style="text-align: center;">Analyses</th> </tr> </thead> <tbody> <tr> <td style="width: 50%;">1.</td> <td style="width: 50%;">2.</td> </tr> <tr> <td>3.</td> <td>4.</td> </tr> <tr> <td>5.</td> <td>6.</td> </tr> <tr> <td>7.</td> <td>8.</td> </tr> </tbody> </table> <p>Other Field Measurements: <u>N/A</u></p> <p>QA/QC samples: _____</p> <p>Sampling Method: <u>Diver collected sample with spoon</u></p> <p>Grab: <u>X</u> Composite: _____</p> <p>Sampler (s): <u>R. La Plant, B.P. McNamara, M. Novak</u></p> <p>Signature: _____</p>	Analyses		1.	2.	3.	4.	5.	6.	7.	8.
Analyses											
1.	2.										
3.	4.										
5.	6.										
7.	8.										

<p>Water Quality Observations: <u>N/A</u></p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>Invertebrate Sample Observations: <u>N/A</u></p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>General Comments: <u>Diver proceeded to river bottom from the boat with sample containers and spoon. Diver placed sediment into containers and returned to boat with the collected sample.</u></p> <p>_____</p>	
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# FIELD SAMPLING DATA SHEET

Sample Type: <u>Sediment-Water Column</u>	Sample Number: <u>010502IW03WCS</u>	Date: <u>5/2/01</u>
Project: <u>Bradford Island</u>	Project Number: <u>52-00080001.00</u>	Task: <u>00004</u>
Weather Conditions: <u>Sunny - 60°F</u>	Sample Matrix: <u>Water Column, sediment, water</u>	
	Comments: <u>Collected duplicate, MS, MSD</u>	

<p>PID/FID Backgd: <u>N/A / N/A</u> ppm</p> <p>Head Space <u>N/A / N/A</u> ppm</p> <p>P.I.D/FID Calibration Standard: <u>N/A</u></p> <p>P.I.D./FID Calibration Date : <u>N/A</u></p> <p>Soil Type: (USCS) <u>GP-SP</u></p> <p>Description: <u>Poorly graded gravel and gravelly sand (gravel 50%, sand 40%). Sand was brown-dark gray, saturated. Very little fines present (&lt;10%).</u></p> <p>Decontamination Method: <u>None – Dedicated stainless steel spoon for sediment, new PVC tubing (3/8" OD, 1/4" ID) for water.</u></p>	<p>Sample Location: <u>Pile #1 - Within Pile at previous sample location 001219BIL03SD</u></p> <p>Sample Depth: <u>12' below water surface</u></p> <p>Sample Time: <u>1400</u></p> <p>No. of Sample Containers: <u>1 glass jar, 4 1 gal. amber bottles</u></p> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th colspan="2" style="text-align: center;">Analyses</th> </tr> </thead> <tbody> <tr><td style="width: 50%;">1.</td><td style="width: 50%;">2.</td></tr> <tr><td>3.</td><td>4.</td></tr> <tr><td>5.</td><td>6.</td></tr> <tr><td>7.</td><td>8.</td></tr> </tbody> </table> <p>Other Field Measurements: <u>N/A</u></p> <p>QA/QC samples: <u>Duplicate, MS, MSD</u></p> <p>Sampling Method: <u>Grab (sediment), peristaltic pump (water)</u></p> <p>Grab: <u>X</u> Composite: _____</p> <p>Sampler (s): <u>B. Dye, B.P. McNamara, M. Novak</u></p> <p>Signature: _____</p>	Analyses		1.	2.	3.	4.	5.	6.	7.	8.
Analyses											
1.	2.										
3.	4.										
5.	6.										
7.	8.										

<p>Water Quality Observations: <u>Collected duplicate sample #010502IW05WCS at 1410. Collected water column sediment sample #010502IW04SS.</u></p> <p>_____</p> <p>_____</p> <p>_____</p> <p>Invertebrate Sample Observations: <u>N/A</u></p> <p>_____</p> <p>_____</p> <p>_____</p> <p>General Comments: <u>Diver proceeded to river bottom from the boat with sample container, spoon, and peristaltic pump tubing. Diver placed sediment into container with spoon. Diver then agitated water column by hand and the peristaltic pump was used to bring water sample to surface for collection.</u></p>
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## FIELD SAMPLING DATA SHEET

Sample Type: <u>Water Column</u>	Sample Number: <u>010502IW06WCS</u>	Date: <u>5/2/01</u>
Project: <u>Bradford Island</u>	Project Number: <u>52-00080001.00</u>	Task: <u>00004</u>
Weather Conditions: <u>Sunny - 65°F</u>	Sample Matrix: <u>Water Column (sediment and water)</u>	
		Comments: _____

PID/FID Backgd: <u>N/A / N/A</u> ppm Head Space <u>N/A / N/A</u> ppm  P.I.D/FID Calibration Standard: <u>N/A</u> P.I.D/FID Calibration Date : <u>N/A</u> Soil Type: (USCS) <u>GP-SP</u>  Description: <u>Poorly graded gravel and gravelly sand (gravel 60%, coarse sand 35%, fines 5%). Sand was brown-dark gray, saturated.</u> _____ _____ _____ _____ _____ _____ _____ Decontamination Method: <u>None – Dedicated stainless steel spoon for Sediment, new PVC tubing (3/8" OD, 1/4" ID) for water.</u>	Sample Location: <u>Pile #1 within pile and previous sample location 001219BIL01SD</u> Sample Depth: <u>28' below water surface</u> Sample Time: <u>1525</u> No. of Sample Containers: <u>1 glass jar, 1 gallon amber</u> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th colspan="2" style="text-align: center;">Analyses</th> </tr> </thead> <tbody> <tr><td style="width: 50%;">1.</td><td style="width: 50%;">2.</td></tr> <tr><td>3.</td><td>4.</td></tr> <tr><td>5.</td><td>6.</td></tr> <tr><td>7.</td><td>8.</td></tr> </tbody> </table> Other Field Measurements: <u>N/A</u> _____ QA/QC samples: <u>N/A</u> Sampling Method: <u>Grab (sediment), peristaltic pump (water)</u> Grab: <u>X</u> Composite: _____ Sampler (s): <u>B. Dye, B.P. McNamara, M. Novak</u> Signature: _____	Analyses		1.	2.	3.	4.	5.	6.	7.	8.
Analyses											
1.	2.										
3.	4.										
5.	6.										
7.	8.										

Water Quality Observations: <u>Slightly silty. Sand particles observed within PVC tubing. Used approximately 80' of tubing to reach sampling location (located 40' east of island). Gravel particle clogged hose @ about 10 feet from diver. Slow pumping due to this (filled approximately 0.75 gallons in 20-30 min as diver agitated sediment at river bottom).</u> _____ _____ Collected water column sediment sample #010502IW06SS. _____ _____ Invertebrate Sample Observations: <u>N/A</u> _____ _____ _____ _____ _____ General Comments: <u>Diver proceeded to river bottom from the boat with sample container, spoon, and peristaltic pump tubing. Diver placed sediment into container with spoon. Diver then agitated water column by hand and the peristaltic pump was used to bring water sample to surface for collection.</u>
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## FIELD SAMPLING DATA SHEET

Sample Type: <u>Sediment</u>	Sample Number: <u>010502IW07SS</u>	Date: <u>5/2/01</u>
Project: <u>Bradford Island</u>	Project Number: <u>52-00080001.00</u>	Task: <u>00004</u>
Weather Conditions: <u>Sunny - 65°F</u>	Sample Matrix: <u>Sediment</u>	
		Comments: _____

<p>PID/FID Backgd: <u>N/A / N/A</u> ppm</p> <p>Head Space <u>N/A / N/A</u> ppm</p> <p>P.I.D/FID Calibration Standard: <u>N/A</u></p> <p>P.I.D/FID Calibration Date : <u>N/A</u></p> <p>Soil Type: (USCS) <u>GP-SP</u></p> <p>Description: <u>Poorly to well graded gravel and gravelly sand (gravel 60%, coarse sand 35%, fines 5%). Sand was brown-dark gray, saturated.</u></p> <p>Decontamination Method: <u>N/A – Dedicated stainless steel spoon.</u></p>	<p>Sample Location: <u>Pile #1 Perimeter</u></p> <p>Sample Depth: _____</p> <p>Sample Time: <u>1625</u></p> <p>No. of Sample Containers: <u>Glass jar</u></p> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th colspan="2" style="text-align: center;">Analyses</th> </tr> </thead> <tbody> <tr><td style="width: 50%;">1.</td><td style="width: 50%;">2.</td></tr> <tr><td>3.</td><td>4.</td></tr> <tr><td>5.</td><td>6.</td></tr> <tr><td>7.</td><td>8.</td></tr> </tbody> </table> <p>Other Field Measurements: <u>N/A</u></p> <p>QA/QC samples: <u>None collected.</u></p> <p>Sampling Method: <u>Diver collected sample with spoon.</u></p> <p>Grab: <u>X</u> Composite: _____</p> <p>Sampler (s): <u>B. Dye, B.P. McNamara, M. Novak</u></p> <p>Signature: _____</p>	Analyses		1.	2.	3.	4.	5.	6.	7.	8.
Analyses											
1.	2.										
3.	4.										
5.	6.										
7.	8.										

<p>Water Quality Observations: <u>N/A</u></p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>Invertebrate Sample Observations: <u>N/A</u></p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>General Comments: <u>Diver proceeded to river bottom from the boat with sample container and spoon. Diver placed sediment into container and returned to boat with the collected sample.</u></p> <p>_____</p> <p>_____</p>	
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## FIELD SAMPLING DATA SHEET

Sample Type: <u>Sediment</u>	Sample Number: <u>010502IW08SS</u>	Date: <u>5/2/01</u>
Project: <u>Bradford Island</u>	Project Number: <u>52-00080001.00</u>	Task: <u>00004</u>
Weather Conditions: <u>Sunny - 65°F</u>	Sample Matrix: <u>Sediment</u>	
		Comments: _____

<p>PID/FID Backgd: <u>N/A / N/A</u> ppm</p> <p>Head Space <u>N/A / N/A</u> ppm</p> <p>P.I.D/FID Calibration Standard: <u>N/A</u></p> <p>P.I.D/FID Calibration Date : <u>N/A</u></p> <p>Soil Type: (USCS) <u>GP-SP</u></p> <p>Description: <u>Poorly to well graded gravel and gravelly sand (gravel 60%, coarse sand 35%, fines 5%). Sand was brown-dark gray, saturated.</u></p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>Decontamination Method: <u>None – Dedicated stainless steel spoon.</u></p> <p>_____</p>	<p>Sample Location: <u>Pile #1 - Perimeter</u></p> <p>_____</p> <p>Sample Depth: _____</p> <p>Sample Time: <u>1645</u></p> <p>No. of Sample Containers: <u>Glass jar</u></p> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th colspan="2" style="text-align: center;">Analyses</th> </tr> </thead> <tbody> <tr> <td style="width: 50%;">1.</td> <td style="width: 50%;">2.</td> </tr> <tr> <td>3.</td> <td>4.</td> </tr> <tr> <td>5.</td> <td>6.</td> </tr> <tr> <td>7.</td> <td>8.</td> </tr> </tbody> </table> <p>Other Field Measurements: <u>N/A</u></p> <p>_____</p> <p>QA/QC samples: <u>None</u></p> <p>Sampling Method: <u>Diver collected sample with spoon.</u></p> <p>Grab: <u>X</u> Composite: _____</p> <p>Sampler (s): <u>B. Dye, B.P. McNamara, M. Novak</u></p> <p>Signature: _____</p>	Analyses		1.	2.	3.	4.	5.	6.	7.	8.
Analyses											
1.	2.										
3.	4.										
5.	6.										
7.	8.										

<p>Water Quality Observations: <u>N/A</u></p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>Invertebrate Sample Observations: <u>N/A</u></p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>General Comments: <u>Diver proceeded to river bottom from the boat with sample container and spoon. Diver placed sediment into container and returned to boat with the collected sample.</u></p> <p>_____</p>	
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# FIELD SAMPLING DATA SHEET

Sample Type: <u>Invertebrate - Tissue</u>	Sample Number: <u>010502IW09TS</u>	Date: <u>5/1/01 to 5/2/01</u>
Project: <u>Bradford Island</u>	Project Number: <u>52-00080001.00</u>	Task: <u>00004</u>
Weather Conditions: <u>Intermittent Rain - 55°F</u>	Sample Matrix: <u>Tissue (Bivalves)</u>	
		Comments: <u>Samples collected from 5/1/01 to 5/2/01</u>

<p>PID/FID Backgd: <u>N/A / N/A</u> ppm</p> <p>Head Space <u>N/A / N/A</u> ppm</p> <p>P.I.D/FID Calibration Standard: <u>N/A</u></p> <p>P.I.D./FID Calibration Date : <u>N/A</u></p> <p>Soil Type: (USCS) _____</p> <p>Description: <u>See Invertebrate Sample observations below.</u></p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>Decontamination Method: <u>N/A</u></p> <p>_____</p> <p>_____</p>	<p>Sample Location: <u>Pile #1. Bivalves collected from various locations throughout pile.</u></p> <p>Sample Depth: <u>Various – collected throughout pile</u></p> <p>Sample Time: <u>Various – collected from 5/1/01 to 5/2/01</u></p> <p>No. of Sample Containers: <u>Two resealable bags</u></p> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th colspan="2" style="text-align: center;">Analyses</th> </tr> </thead> <tbody> <tr> <td style="width: 50%;">1.</td> <td style="width: 50%;">2.</td> </tr> <tr> <td>3.</td> <td>4.</td> </tr> <tr> <td>5.</td> <td>6.</td> </tr> <tr> <td>7.</td> <td>8.</td> </tr> </tbody> </table> <p>Other Field Measurements: <u>Measured length, width &amp; weight.</u></p> <p>_____</p> <p>QA/QC samples: <u>None</u></p> <p>Sampling Method: <u>Grab by Diver</u></p> <p>Grab: <u>X</u> Composite: _____</p> <p>Sampler (s): <u>D. Tsugawa, B.P. McNamara, M. Novak</u></p> <p>Signature: _____</p>	Analyses		1.	2.	3.	4.	5.	6.	7.	8.
Analyses											
1.	2.										
3.	4.										
5.	6.										
7.	8.										

<p>Water Quality Observations: <u>N/A</u></p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p>
<p>Invertebrate Sample Observations: <u>63 total bivalves (corbicula flumiea) collected. Specimen shells were green-brown, were symmetrical, and were approximately the size of a quarter-dollar coin. Average sizes are as follows:</u></p> <p><u>Length 21.22 millimeters</u></p> <p><u>Width 14.38 millimeters</u></p> <p><u>Weight: 7.87 grams</u></p> <p>_____</p> <p>_____</p>
<p>General Comments: <u>Bivalves were collected over two days, while diver performed other tasks. Diver collected specimens from the river bottom and placed them (temporarily) in a dedicated plastic collection container. Diver returned the specimens to the boat where they were measured, wrapped in acetone-rinsed foil, triple-bagged, and placed on ice.</u></p>



## FIELD SAMPLING DATA SHEET

Sample Type: <u>Water Column</u>	Sample Number: <u>010503IW10WCS</u>	Date: <u>5/3/01</u>
Project: <u>Bradford Island</u>	Project Number: <u>52-00080001.00</u>	Task: <u>00004</u>
Weather Conditions: <u>Sunny - 65°F</u>	Sample Matrix: <u>Water Column</u>	
		Comments: _____

<p>PID/FID Backgd: <u>N/A / N/A</u> ppm</p> <p>Head Space <u>N/A / N/A</u> ppm</p> <p>P.I.D/FID Calibration Standard: <u>N/A</u></p> <p>P.I.D/FID Calibration Date : <u>N/A</u></p> <p>Soil Type: (USCS) <u>SW-SP</u></p> <p>Description: <u>Well graded to poorly graded gravelly sand.</u></p> <p><u>Color is medium brown to dark grayish brown; saturated</u></p> <p><u>(standing water w/in container). Grain size: coarse medium</u></p> <p><u>sand 50%; silty (suspended in water) material 15%; gravel (fine</u></p> <p><u>to coarse - .20" – 1.5") 30%; organic material 5% (roots, tree</u></p> <p><u>twigs).</u></p> <p>_____</p> <p>_____</p> <p>Decontamination Method: <u>Dedicated stainless steel spoon for</u></p> <p><u>sediment, new PVC tubing (3/8" OD, 1/4" ID) for water.</u></p> <p>_____</p>	<p>Sample Location: <u>Goose Island – Background Location</u></p> <p>_____</p> <p>Sample Depth: <u>20' below water surface</u></p> <p>Sample Time: <u>0905</u></p> <p>No. of Sample Containers: <u>1 glass jar &amp; 1 amber gal. bottle</u></p> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th colspan="2" style="text-align: center;">Analyses</th> </tr> </thead> <tbody> <tr> <td style="width: 50%;">1.</td> <td style="width: 50%;">2.</td> </tr> <tr> <td>3.</td> <td>4.</td> </tr> <tr> <td>5.</td> <td>6.</td> </tr> <tr> <td>7.</td> <td>8.</td> </tr> </tbody> </table> <p>Other Field Measurements: _____</p> <p>_____</p> <p>QA/QC samples: <u>QA</u></p> <p>Sampling Method: <u>Grab and peristaltic pump</u></p> <p>Grab: _____ Composite: _____</p> <p>Sampler (s): <u>D. Tsugawa, B.P. McNamara, M. Novak</u></p> <p>Signature: _____</p>	Analyses		1.	2.	3.	4.	5.	6.	7.	8.
Analyses											
1.	2.										
3.	4.										
5.	6.										
7.	8.										

<p>Water Quality Observations: <u>More silt present in this area of Goose Island. More fine material visible in PVC tubing.</u></p> <p><u>Collected water column sediment sample #0105031W10SS. Sediment is described above.</u></p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>Invertebrate Sample Observations: <u>N/A</u></p> <p>_____</p> <p>_____</p> <p>_____</p> <p>General Comments: <u>Diver proceeded to river bottom from the boat with sample container, spoon, and peristaltic pump</u></p> <p><u>tubing. Diver placed sediment into container with spoon. Diver then agitated water column by hand and the peristaltic</u></p> <p><u>pump was used to bring water sample to surface for collection.</u></p> <p>_____</p>
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## FIELD SAMPLING DATA SHEET

Sample Type: <u>Water Column</u>	Sample Number: <u>010503IW11WCS</u>	Date: <u>5/3/01</u>
Project: <u>Bradford Island</u>	Project Number: <u>52-00080001.00</u>	Task: <u>00004</u>
Weather Conditions: <u>Sunny - 70°F</u>	Sample Matrix: <u>Sediment, Water</u>	
		Comments: _____

<p>PID/FID Backgd: <u>N/A / N/A</u> ppm</p> <p>Head Space <u>N/A / N/A</u> ppm</p> <p>P.I.D/FID Calibration Standard: <u>N/A</u></p> <p>P.I.D/FID Calibration Date : <u>N/A</u></p> <p>Soil Type: (USCS) <u>SP</u></p> <p>Description: <u>Poorly graded gravelly sand. Color is dark brown; saturated (standing water within container). Coarse to medium sand predominates 60%; gravel is fine (0.25") 30%; water/fines 10%.</u></p> <p>Decontamination Method: <u>None - Dedicated stainless steel spoon for sediment, new PVC tubing (3/8" OD, 1/4" ID) for water.</u></p>	<p>Sample Location: <u>Pile #2 – within pile near lightning arrestor.</u></p> <p>Sample Depth: <u>23' below water surface</u></p> <p>Sample Time: <u>1020</u></p> <p>No. of Sample Containers: <u>3 glass jars, one-gallon amber</u></p> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th colspan="2" style="text-align: center;">Analyses</th> </tr> </thead> <tbody> <tr><td style="width: 50%;">1.</td><td style="width: 50%;">2.</td></tr> <tr><td>3.</td><td>4.</td></tr> <tr><td>5.</td><td>6.</td></tr> <tr><td>7.</td><td>8.</td></tr> </tbody> </table> <p>Other Field Measurements: _____</p> <p>QA/QC samples: <u>Duplicate, MS, MSD</u></p> <p>Sampling Method: _____</p> <p>Grab: <u>X</u> Composite: _____</p> <p>Sampler (s): <u>D. Tsugawa, B.P. McNamara, M. Novak</u></p> <p>Signature: _____</p>	Analyses		1.	2.	3.	4.	5.	6.	7.	8.
Analyses											
1.	2.										
3.	4.										
5.	6.										
7.	8.										

<p>Water Quality Observations: <u>Collected duplicate sample (#0105031W12SS) in one jar and MS/MSD in one jar (#0105031S11SS).</u></p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>Invertebrate Sample Observations: <u>N/A</u></p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>General Comments: <u>Diver proceeded to river bottom from the boat with sample container, spoon, and peristaltic pump tubing. Diver placed sediment into container with spoon. Diver then agitated water column by hand and the peristaltic pump was used to bring water sample to surface for collection.</u></p>
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## FIELD SAMPLING DATA SHEET

Sample Type: <u>Sediment</u>	Sample Number: <u>010503IW13SS</u>	Date: <u>5/3/01</u>
Project: <u>Bradford Island</u>	Project Number: <u>52-00080001.00</u>	Task: <u>00004</u>
Weather Conditions: <u>Sunny - 70°F</u>	Sample Matrix: <u>Sediment</u>	
		Comments: _____

<p>PID/FID Backgd: <u>N/A / N/A</u> ppm</p> <p>Head Space <u>N/A / N/A</u> ppm</p> <p>P.I.D/FID Calibration Standard: <u>N/A</u></p> <p>P.I.D./FID Calibration Date : <u>N/A</u></p> <p>Soil Type: (USCS) <u>SP-GP</u></p> <p>Description: <u>Poorly graded gravelly sand. Color is dark brown; saturated (standing water within container). Coarse to medium sand predominates 50-60%; gravel is fine (0.25") 40-50%; water/fines 5%. Standing water present within jar. Gravel size up to 1.5" in diameter.</u></p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>Decontamination Method: <u>None - dedicated stainless steel spoon.</u></p> <p>_____</p>	<p>Sample Location: <u>Pile #2</u></p> <p>_____</p> <p>Sample Depth: <u>35' below water surface</u></p> <p>Sample Time: <u>1230</u></p> <p>No. of Sample Containers: <u>1 Ziplock bag, 1 glass jar</u></p> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th colspan="2" style="text-align: center;">Analyses</th> </tr> </thead> <tbody> <tr> <td style="width: 50%;">1.</td> <td style="width: 50%;">2.</td> </tr> <tr> <td>3.</td> <td>4.</td> </tr> <tr> <td>5.</td> <td>6.</td> </tr> <tr> <td>7.</td> <td>8.</td> </tr> </tbody> </table> <p>Other Field Measurements: <u>N/A</u></p> <p>_____</p> <p>QA/QC samples: <u>None</u></p> <p>Sampling Method: <u>Diver collected sample with spoon.</u></p> <p>Grab: <u>X</u> Composite: _____</p> <p>Sampler (s): <u>Dennis Tsugawa., B.P. McNamara, M. Novak</u></p> <p>Signature: _____</p>	Analyses		1.	2.	3.	4.	5.	6.	7.	8.
Analyses											
1.	2.										
3.	4.										
5.	6.										
7.	8.										

<p>Water Quality Observations: <u>N/A</u></p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>Invertebrate Sample Observations: <u>N/A</u></p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>General Comments: <u>Diver proceeded to river bottom from the boat with sample containers and spoon. Diver placed sediment into containers and returned to boat with the collected sample. Sediment within grain size (ziplock) bag is of larger nature (gravel 1.5").</u></p>	
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## FIELD SAMPLING DATA SHEET

Sample Type: <u>Sediment</u>	Sample Number: <u>010503IW14SS</u>	Date: <u>5/3/01</u>
Project: <u>Bradford Island</u>	Project Number: <u>52-00080001.00</u>	Task: <u>00004</u>
Weather Conditions: <u>Sunny - 70°F</u>	Sample Matrix: <u>Sediment</u>	
		Comments: _____

<p>PID/FID Backgd: <u>N/A / N/A</u> ppm</p> <p>Head Space <u>N/A / N/A</u> ppm</p> <p>P.I.D/FID Calibration Standard: <u>N/A</u></p> <p>P.I.D./FID Calibration Date : <u>N/A</u></p> <p>Soil Type: (USCS) <u>SP</u></p> <p>Description: <u>Poorly graded gravelly sand. Color is dark brown; saturated (standing water within container). Coarse to medium sand predominates 60%; gravel is fine (0.25") 30%; water/fines 10%.</u></p> <p>Decontamination Method: <u>None - dedicated stainless steel spoon.</u></p>	<p>Sample Location: <u>Pile #2 – Within Pile</u></p> <p>Sample Depth: <u>30' below water surface</u></p> <p>Sample Time: <u>1240</u></p> <p>No. of Sample Containers: <u>QA, Duplicate, MS &amp; MSD</u></p> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th colspan="2" style="text-align: center;">Analyses</th> </tr> </thead> <tbody> <tr><td>1.</td><td>2.</td></tr> <tr><td>3.</td><td>4.</td></tr> <tr><td>5.</td><td>6.</td></tr> <tr><td>7.</td><td>8.</td></tr> </tbody> </table> <p>Other Field Measurements: <u>N/A</u></p> <p>QA/QC samples: <u>QA, duplicate, MS &amp; MSD</u></p> <p>Sampling Method: <u>Diver collected sample with spoon.</u></p> <p>Grab: <u>X</u> Composite: _____</p> <p>Sampler (s): <u>D. Tsugawa, B.P. McNamara, M. Novak</u></p> <p>Signature: _____</p>	Analyses		1.	2.	3.	4.	5.	6.	7.	8.
Analyses											
1.	2.										
3.	4.										
5.	6.										
7.	8.										

<p>Water Quality Observations: <u>N/A</u></p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>Invertebrate Sample Observations: <u>N/A</u></p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>General Comments: <u>Collected MS/MSD/QA samples. Collected sample duplicate #010503IW15SS. Diver proceeded to river bottom from the boat with sample containers and spoon. Diver placed sediment into containers and returned to boat with the collected sample.</u></p> <p>_____</p> <p>_____</p>	
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## FIELD SAMPLING DATA SHEET

Sample Type: <u>Sediment</u>	Sample Number: <u>010503IW16SS</u>	Date: <u>5/3/01</u>
Project: <u>Bradford Island</u>	Project Number: <u>52-00080001.00</u>	Task: <u>00004</u>
Weather Conditions: <u>Sunny - 70°F</u>	Sample Matrix: <u>Sediment</u>	
		Comments: _____

<p>PID/FID Backgd: <u>N/A / N/A</u> ppm</p> <p>Head Space <u>N/A / N/A</u> ppm</p> <p>P.I.D/FID Calibration Standard: <u>N/A</u></p> <p>P.I.D/FID Calibration Date : <u>N/A</u></p> <p>Soil Type: (USCS) <u>SP</u></p> <p>Description: <u>Poorly graded gravelly sand. Color is dark brown; saturated (standing water within container). Coarse to medium sand predominates 60%; gravel is fine (0.25") 30%; water/fines 10%.</u></p> <p>Decontamination Method: <u>None. Dedicated stainless steel spoon.</u></p>	<p>Sample Location <u>Pile #2 – west perimeter</u></p> <p>Sample Depth: <u>38' below water surface</u></p> <p>Sample Time: <u>1340</u></p> <p>No. of Sample Containers: <u>1 glass jar</u></p> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th colspan="2" style="text-align: center;">Analyses</th> </tr> </thead> <tbody> <tr><td>1.</td><td>2.</td></tr> <tr><td>3.</td><td>4.</td></tr> <tr><td>5.</td><td>6.</td></tr> <tr><td>7.</td><td>8.</td></tr> </tbody> </table> <p>Other Field Measurements: <u>N/A</u></p> <p>QA/QC samples: <u>N/A</u></p> <p>Sampling Method: <u>Diver collected sample with spoon.</u></p> <p>Grab: <u>X</u> Composite: _____</p> <p>Sampler (s): <u>R. LaPlant., B.P. McNamara, M. Novak</u></p> <p>Signature: _____</p>	Analyses		1.	2.	3.	4.	5.	6.	7.	8.
Analyses											
1.	2.										
3.	4.										
5.	6.										
7.	8.										

<p>Water Quality Observations: <u>N/A</u></p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>Invertebrate Sample Observations: <u>N/A</u></p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>General Comments: <u>Diver proceeded to river bottom from the boat with sample container and spoon. Diver placed sediment into container and returned to boat with the collected sample.</u></p> <p>_____</p> <p>_____</p>	
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## FIELD SAMPLING DATA SHEET

Sample Type: <u>Sediment</u>	Sample Number: <u>010503IW17SS</u>	Date: <u>5/3/01</u>
Project: <u>Bradford Island</u>	Project Number: <u>52-00080001.00</u>	Task: <u>00004</u>
Weather Conditions: <u>Sunny - 70°F</u>	Sample Matrix: <u>Sediment</u>	
		Comments: _____

<p>PID/FID Backgd: <u>N/A / N/A</u> ppm</p> <p>Head Space <u>N/A / N/A</u> ppm</p> <p>P.I.D/FID Calibration Standard: <u>N/A</u></p> <p>P.I.D./FID Calibration Date : <u>N/A</u></p> <p>Soil Type: (USCS) <u>SP</u></p> <p>Description: <u>Poorly graded gravelly sand. Color is dark brown; saturated (standing water within container). Coarse to medium sand predominates 60%; gravel is fine (0.25") 30%; water/fines 10%.</u></p> <p>Decontamination Method: <u>None - dedicated stainless steel spoon.</u></p>	<p>Sample Location <u>Pile #2 – Within Pile</u></p> <p>Sample Depth: <u>35' below water surface</u></p> <p>Sample Time: <u>1350</u></p> <p>No. of Sample Containers: <u>1 glass jar</u></p> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th colspan="2" style="text-align: center;">Analyses</th> </tr> </thead> <tbody> <tr><td style="width: 50%;">1.</td><td style="width: 50%;">2.</td></tr> <tr><td>3.</td><td>4.</td></tr> <tr><td>5.</td><td>6.</td></tr> <tr><td>7.</td><td>8.</td></tr> </tbody> </table> <p>Other Field Measurements: <u>N/A</u></p> <p>QA/QC samples: <u>None</u></p> <p>Sampling Method: <u>Diver collected sample with spoon.</u></p> <p>Grab: <u>X</u> Composite: _____</p> <p>Sampler (s): <u>R. LaPlant., B.P. McNamara, M. Novak</u></p> <p>Signature: _____</p>	Analyses		1.	2.	3.	4.	5.	6.	7.	8.
Analyses											
1.	2.										
3.	4.										
5.	6.										
7.	8.										

<p>Water Quality Observations: <u>N/A</u></p> <p> </p> <p> </p> <p> </p> <p> </p> <p>Invertebrate Sample Observations: <u>N/A</u></p> <p> </p> <p> </p> <p> </p> <p> </p> <p> </p>	<p>General Comments: <u>Diver proceeded to river bottom from the boat with sample container and spoon. Diver placed sediment into container and returned to boat with the collected sample.</u></p> <p> </p> <p> </p>
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## FIELD SAMPLING DATA SHEET

Sample Type: <u>Sediment</u>	Sample Number: <u>010503SBDS18SS</u>	Date: <u>5/3/01</u>
Project: <u>Bradford Island</u>	Project Number: <u>52-00080001.00</u>	Task: <u>00004</u>
Weather Conditions: <u>Sunny - 70°F</u>	Sample Matrix: <u>Sediment</u>	
		Comments: _____

<p>PID/FID Backgd: <u>N/A / N/A</u> ppm</p> <p>Head Space <u>N/A / N/A</u> ppm</p> <p>P.I.D/FID Calibration Standard: <u>N/A</u></p> <p>P.I.D./FID Calibration Date : <u>N/A</u></p> <p>Soil Type: (USCS) <u>SP-SM</u></p> <p>Description: <u>Poorly graded medium sand with some gravel.</u>  <u>Dark brown/gray; saturated (standing water within containers).</u>  <u>Medium sand predominates (70%) some gravel</u>  <u>10-20% and silt (10-15%). Gravel present up to 2" in</u>  <u>diameter.</u></p> <p>Decontamination Method: <u>None - dedicated stainless steel</u>  <u>spoon.</u></p>	<p>Sample Location <u>Drain Outfall #2</u></p> <p>Sample Depth: <u>8' and 14' (not enough sediment @ 8')</u></p> <p>Sample Time: <u>1540</u></p> <p>No. of Sample Containers: <u>1 glass jar, 2 liter plastic for TBT</u></p> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th colspan="2" style="text-align: center;">Analyses</th> </tr> </thead> <tbody> <tr><td style="width: 50%;">2.</td><td style="width: 50%;">2.</td></tr> <tr><td>4.</td><td>4.</td></tr> <tr><td>6.</td><td>6.</td></tr> <tr><td>8.</td><td>8.</td></tr> </tbody> </table> <p>Other Field Measurements: <u>N/A</u></p> <p>QA/QC samples: <u>None</u></p> <p>Sampling Method: <u>Diver collected sample with spoon.</u></p> <p>Grab: <u>X</u> Composite: _____</p> <p>Sampler (s): <u>R. LaPlant., B.P. McNamara, M. Novak</u></p> <p>Signature: _____</p>	Analyses		2.	2.	4.	4.	6.	6.	8.	8.
Analyses											
2.	2.										
4.	4.										
6.	6.										
8.	8.										

<p>Water Quality Observations: _____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p>
<p>Invertebrate Sample Observations: <u>N/A</u></p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p>
<p>General Comments: <u>Contains (sample does) algal-like material – greenish-brown, flaky, suspended). Diver moved</u>  <u>to 14' below water surface (from 8') due to lack of sediment at 8'. Diver proceeded to river bottom from the boat with</u>  <u>sample container and spoon. Diver placed sediment into container and returned to boat with the collected sample.</u></p> <p>_____</p>

## FIELD SAMPLING DATA SHEET

Sample Type: <u>Sediment</u>	Sample Number: <u>010503SBDS19SS</u>	Date: <u>5/3/01</u>
Project: <u>Bradford Island</u>	Project Number: <u>52-00080001.00</u>	Task: <u>00004</u>
Weather Conditions: <u>Sunny - 70°F</u>	Sample Matrix: <u>Sediment</u>	
		Comments: _____

PID/FID Backgd: <u>N/A / N/A</u> ppm Head Space <u>N/A / N/A</u> ppm  P.I.D/FID Calibration Standard: <u>N/A</u> P.I.D./FID Calibration Date : <u>N/A</u> Soil Type: (USCS) <u>SP-SM</u> Description: <u>Poorly graded medium sand with some gravel.</u> <u>Dark brown/gray; saturated (standing water within containers).</u> <u>Medium-sand predominates (70%) some gravel 10-20% and</u> <u>silt (10-15%). Gravel present up to 2" in diameter.</u>      Decontamination Method: <u>None - dedicated stainless steel</u> <u>spoon.</u>	Sample Location <u>Drain #1 (eastern drain outfall)</u>  Sample Depth: <u>3' below water surface</u> Sample Time: <u>1605</u> No. of Sample Containers: <u>1 glass jar, 6 liter plastic for TBT</u> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th colspan="2" style="text-align: center;">Analyses</th> </tr> </thead> <tbody> <tr> <td style="width: 50%;">1.</td> <td style="width: 50%;">2.</td> </tr> <tr> <td>3.</td> <td>4.</td> </tr> <tr> <td>5.</td> <td>6.</td> </tr> <tr> <td>7.</td> <td>8.</td> </tr> </tbody> </table> Other Field Measurements: <u>N/A</u>  QA/QC samples: <u>MS, MSD, Duplicate</u> Sampling Method: <u>Diver collected sample with spoon.</u>  Grab: <u>X</u> Composite: _____ Sampler (s): <u>R. LaPlant., B.P. McNamara, M. Novak</u> Signature: _____	Analyses		1.	2.	3.	4.	5.	6.	7.	8.
Analyses											
1.	2.										
3.	4.										
5.	6.										
7.	8.										

Water Quality Observations: <u>Algal-like material present within water column. Material appears greenish-brown, 2 mm or smaller,</u> <u>planar-shaped, and is easily entrained with slight agitation.</u>    
Invertebrate Sample Observations: <u>N/A</u>    
General Comments: <u>Sample #010503SBDS20SS is the duplicate sample. Diver proceeded to river bottom from the</u> <u>boat with sample containers and spoon. Diver placed sediment into containers and returned to boat with the collected</u> <u>sample.</u>



## FIELD SAMPLING DATA SHEET

Sample Type: <u>Tissue</u>	Sample Number: <u>0105031W21TS</u>	Date: <u>5/3/01</u>
Project: <u>Bradford Island</u>	Project Number: <u>52-00080001.00</u>	Task: <u>00004</u>
Weather Conditions: <u>Sunny</u>	Sample Matrix: <u>Tissue (Bivalves)</u>	
		Comments: _____

<p>PID/FID Backgd: <u>N/A / N/A</u> ppm</p> <p>Head Space <u>N/A / N/A</u> ppm</p> <p>P.I.D/FID Calibration Standard: <u>N/A</u></p> <p>P.I.D./FID Calibration Date : <u>N/A</u></p> <p>Soil Type: (USCS) _____</p> <p>Description: <u>See Invertebrate Sample observations below</u></p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>Decontamination Method: <u>N/A</u></p> <p>_____</p> <p>_____</p>	<p>Sample Location <u>Background location (Goose Island).</u></p> <p>Sample Depth: <u>Various – from river bottom.</u></p> <p>Sample Time: <u>Various - collected on 5/3/1.</u></p> <p>No. of Sample Containers: <u>1 resealable bag</u></p> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th colspan="2" style="text-align: center;">Analyses</th> </tr> </thead> <tbody> <tr> <td style="width: 50%;">1.</td> <td style="width: 50%;">2.</td> </tr> <tr> <td>3.</td> <td>4.</td> </tr> <tr> <td>5.</td> <td>6.</td> </tr> <tr> <td>7.</td> <td>8.</td> </tr> </tbody> </table> <p>Other Field Measurements: <u>Measured length, width &amp; weight</u></p> <p>_____</p> <p>QA/QC samples: <u>N/A</u></p> <p>Sampling Method: <u>Grab by diver</u></p> <p>Grab: <u>X</u> Composite: _____</p> <p>Sampler (s): <u>D. Tsugawa, B.P. McNamara, M. Novak</u></p> <p>Signature: _____</p>	Analyses		1.	2.	3.	4.	5.	6.	7.	8.
Analyses											
1.	2.										
3.	4.										
5.	6.										
7.	8.										

<p>Water Quality Observations: <u>N/A</u></p> <p>_____</p> <p>_____</p> <p>_____</p>
<p>Invertebrate Sample Observations: <u>Collected 50 total bivalves (corbicula flumiea). Specimen shells were green-brown, were symmetrical, and were approximately the size of a quarter-dollar coin. Average sizes are as follows:</u></p> <p><u>Length 24.25 millimeters</u></p> <p><u>Width 16.39 millimeters</u></p> <p><u>Weight: scale became inoperable</u></p> <p>_____</p> <p>_____</p>
<p>General Comments: <u>Bivalves were collected over several hours while boat was anchored at Goose Island. Diver collected specimens from the river bottom and placed them (temporarily) in a dedicated plastic collection container. Diver returned the specimens to the boat where they were measured, wrapped in acetone-rinsed foil, triple-bagged, and placed on ice.</u></p> <p>_____</p>

## FIELD SAMPLING DATA SHEET

Sample Type: <u>Invertebrate (clams)</u>	Sample Number: <u>0105031W23TS</u>	Date: <u>5/1/01 to 5/3/01</u>
Project: <u>Bradford Island</u>	Project Number: <u>52-00080001.00</u>	Task: <u>00004</u>
Weather Conditions: _____	Sample Matrix: <u>Tissue (Bivalves)</u>	
_____	Comments: _____	

<p>PID/FID Backgd: <u>N/A / N/A</u> ppm</p> <p>Head Space <u>N/A / N/A</u> ppm</p> <p>P.I.D/FID Calibration Standard: <u>N/A</u></p> <p>P.I.D./FID Calibration Date : <u>N/A</u></p> <p>Soil Type: (USCS) <u>N/A</u></p> <p>Description: <u>See Invertebrate Sample observations below.</u></p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>Decontamination Method: <u>N/A</u></p> <p>_____</p> <p>_____</p>	<p>Sample Location: <u>Pile #2. Bivalves collected from various locations throughout pile.</u></p> <p>Sample Depth: <u>Various – collected throughout pile.</u></p> <p>Sample Time: <u>Various - collected from 5/1/1 to 5/3/1.</u></p> <p>No. of Sample Containers: <u>3 resealable bags</u></p> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th colspan="2" style="text-align: center;">Analyses</th> </tr> </thead> <tbody> <tr> <td style="width: 50%;">1.</td> <td style="width: 50%;">2.</td> </tr> <tr> <td>3.</td> <td>4.</td> </tr> <tr> <td>5.</td> <td>6.</td> </tr> <tr> <td>7.</td> <td>8.</td> </tr> </tbody> </table> <p>Other Field Measurements: <u>Measured length, width &amp; weight</u></p> <p>_____</p> <p>QA/QC samples: <u>MS/MSD, Duplicate</u></p> <p>Sampling Method: <u>Grab by diver</u></p> <p>Grab: <u>X</u> Composite: _____</p> <p>Sampler (s): <u>Ben Dye, B.P. McNamara, M. Novak</u></p> <p>Signature: _____</p>	Analyses		1.	2.	3.	4.	5.	6.	7.	8.
Analyses											
1.	2.										
3.	4.										
5.	6.										
7.	8.										

<p>Water Quality Observations: <u>N/A</u></p> <p>_____</p> <p>_____</p> <p>_____</p>
<p>Invertebrate Sample Observations: <u>Collected 215 total bivalves (corbicula flumiea). Specimen shells were green-brown, were symmetrical, and were approximately the size of a quarter-dollar coin. Average sizes are as follows:</u></p> <p><u>Length 23.10 millimeters</u></p> <p><u>Width 15.17 millimeters</u></p> <p><u>Weight 7.70 grams</u></p> <p>_____</p> <p>_____</p>
<p>General Comments: <u>Collected matrix spike (MS), matrix spike duplicate (MSD), and duplicate sample (sample #0105031W24TS). Samples collected by diver over course of three days (May 1-3, 2001). Diver collected specimens from the river bottom and placed them (temporarily) in a dedicated plastic collection container. Diver returned the specimens to the boat where they were measured, wrapped in acetone-rinsed foil, triple-bagged, and placed on ice.</u></p> <p>_____</p> <p>_____</p>

## FIELD SAMPLING DATA SHEET

Sample Type: <u>Invertebrate - Tissue</u>	Sample Number: <u>0105031W22TS</u>	Date: <u>4/30/01 to 5/3/01</u>
Project: <u>Bradford Island</u>	Project Number: <u>52-00080001.00</u>	Task: <u>00004</u>
Weather Conditions: <u>Rain - Intermittent</u>	Sample Matrix: <u>Tissue (Bivalves)</u>	
		Comments: <u>Collected QA sample</u>

<p>PID/FID Backgd: <u>N/A / N/A</u> ppm</p> <p>Head Space <u>N/A / N/A</u> ppm</p> <p>P.I.D/FID Calibration Standard: <u>N/A</u></p> <p>P.I.D./FID Calibration Date : <u>N/A</u></p> <p>Soil Type: (USCS) <u>N/A</u></p> <p>Description: <u>See Invertebrate Sample observations below.</u></p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>Decontamination Method: <u>N/A</u></p> <p>_____</p> <p>_____</p>	<p>Sample Location <u>Pile #2 Bivalves collected from various locations throughout pile.</u></p> <p>Sample Depth: <u>Various – collected throughout pile</u></p> <p>Sample Time: <u>Various – samples collected from 4/30 to 5/3</u></p> <p>No. of Sample Containers: <u>2 resealable bags</u></p> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th colspan="2" style="text-align: center;">Analyses</th> </tr> </thead> <tbody> <tr> <td style="width: 50%;">1.</td> <td style="width: 50%;">2.</td> </tr> <tr> <td>3.</td> <td>4.</td> </tr> <tr> <td>5.</td> <td>6.</td> </tr> <tr> <td>7.</td> <td>8.</td> </tr> </tbody> </table> <p>Other Field Measurements: <u>Measured length, width &amp; weight.</u></p> <p>_____</p> <p>QA/QC samples: <u>Collected QA sample</u></p> <p>Sampling Method: <u>Grab by diver</u></p> <p>Grab: <u>X</u> Composite: _____</p> <p>Sampler (s): <u>R. LaPlant, B.P. McNamara, M. Novak</u></p> <p>Signature: _____</p>	Analyses		1.	2.	3.	4.	5.	6.	7.	8.
Analyses											
1.	2.										
3.	4.										
5.	6.										
7.	8.										

<p>Water Quality Observations: <u>N/A</u></p> <p>_____</p> <p>_____</p> <p>_____</p>
<p>Invertebrate Sample Observations:</p> <p><u>Collected 145 total bivalves (corbicula fluminea). Specimen shells were green-brown, were symmetrical, and were approximately the size of a quarter-dollar coin. Average sizes are as follows:</u></p> <p><u>Length 26.56 millimeters</u></p> <p><u>Width 16.47 millimeters</u></p> <p><u>Weight 19.44 grams</u></p> <p>_____</p> <p>_____</p> <p>_____</p>
<p>General Comments: <u>Collected QA sample #0105031W22TS. Samples collected by diver over course of four days.</u></p> <p><u>Diver collected specimens from the river bottom and placed them (temporarily) in a dedicated plastic collection container.</u></p> <p><u>Diver returned the specimens to the boat where they were measured, wrapped in acetone-rinsed foil, triple-bagged, and placed on ice.</u></p> <p>_____</p>

## FIELD SAMPLING DATA SHEET

Sample Type: <u>Sediment</u>	Sample Number: <u>010504SBDS24SS</u>	Date: <u>5/4/01</u>
Project: <u>Bradford Island</u>	Project Number: <u>52-00080001.00</u>	Task: <u>00004</u>
Weather Conditions: <u>Sunny, 65° F, windy</u>	Sample Matrix: <u>Sediment</u>	
		Comments: _____

<p>PID/FID Backgd: <u>N/A / N/A</u> ppm</p> <p>Head Space <u>N/A / N/A</u> ppm</p> <p>P.I.D/FID Calibration Standard: <u>N/A</u></p> <p>P.I.D./FID Calibration Date : <u>N/A</u></p> <p>Soil Type: (USCS) <u>SM</u></p> <p>Description: <u>Silty sand. Color is brown to dark brown; wet, no cementation. Grain size: medium to coarse sand (65-75%), silt (5%), organic material (20-35%). Organic material consists of grass vegetation, roots, dead leaves. Thin veneer of this sediment (&lt; 6") on top of gravel and rock.</u></p> <p>Decontamination Method: <u>None - dedicated stainless steel spoon used.</u></p>	<p>Sample Location <u>Sandblast Building. Catch Basin #2 (western drain).</u></p> <p>Sample Depth: <u>&lt; 6" below ground surface.</u></p> <p>Sample Time: <u>1500</u></p> <p>No. of Sample Containers: _____</p> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th colspan="2" style="text-align: center;">Analyses</th> </tr> </thead> <tbody> <tr><td style="width: 50%;">1.</td><td style="width: 50%;">2.</td></tr> <tr><td>3.</td><td>4.</td></tr> <tr><td>5.</td><td>6.</td></tr> <tr><td>7.</td><td>8.</td></tr> </tbody> </table> <p>Other Field Measurements: <u>N/A</u></p> <p>QA/QC samples: <u>None</u></p> <p>Sampling Method: <u>Grab with spoon.</u></p> <p>Grab: <u>X</u> Composite: _____</p> <p>Sampler (s): <u>B.P. McNamara</u></p> <p>Signature: _____</p>	Analyses		1.	2.	3.	4.	5.	6.	7.	8.
Analyses											
1.	2.										
3.	4.										
5.	6.										
7.	8.										

<p>Water Quality Observations: <u>N/A</u></p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p>	<p>Invertebrate Sample Observations: <u>N/A</u></p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p>
<p>General Comments: <u>Poor sample collected from the drain on 5/1/01 (mostly gravel and pebbles with the catch basin. USACE (P. Huebschman) requested we collect this sample from the low area surrounding the catch basin.</u></p> <p>_____</p> <p>_____</p>	

## FIELD SAMPLING DATA SHEET

Sample Type: <u>Invertebrate - Tissue</u>	Sample Number: <u>0105031W28TS</u>	Date: <u>5/9/01 &amp; 6/19/01</u>
Project: <u>Bradford Island</u>	Project Number: <u>52-00080001.00</u>	Task: <u>00004</u>
Weather Conditions: <u>Sunny</u>	Sample Matrix: <u>Tissue (Crayfish)</u>	
		Comments: _____

PID/FID Backgd: <u>N/A / N/A</u> ppm Head Space <u>N/A / N/A</u> ppm  P.I.D/FID Calibration Standard: <u>N/A</u> P.I.D./FID Calibration Date : <u>N/A</u> Soil Type: (USCS) <u>N/A</u> Description: <u>See Invertebrate Sample observations below.</u> _____ _____ _____ _____ _____ _____ _____ _____ Decontamination Method: <u>N/A</u> _____ _____ _____	Sample Location: <u>Pile #1</u> _____ Sample Depth: <u>Various – collected throughout pile</u> Sample Time: <u>Various – samples collected on 5/9/01 &amp; 6/19/01</u> No. of Sample Containers: <u>1 resealable bag</u> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th colspan="2" style="text-align: center;">Analyses</th> </tr> </thead> <tbody> <tr><td style="width: 50%;">2.</td><td style="width: 50%;">2.</td></tr> <tr><td>4.</td><td>4.</td></tr> <tr><td>6.</td><td>6.</td></tr> <tr><td>8.</td><td>8.</td></tr> </tbody> </table> Other Field Measurements: <u>Measured claw length, abdomen length &amp; weight.</u> QA/QC samples: <u>None</u> Sampling Method: <u>Baited (with canned tuna) crayfish traps.</u> Grab: <u>X</u> Composite: _____ Sampler (s): <u>B.P. McNamara, M. Novak, C.Moody</u> Signature: _____	Analyses		2.	2.	4.	4.	6.	6.	8.	8.
Analyses											
2.	2.										
4.	4.										
6.	6.										
8.	8.										

Water Quality Observations: <u>N/A</u> _____ _____ _____ _____ _____
Invertebrate Sample Observations: <u>Collected 6 total Crayfish (pacifastacus sp.). Specimens were dark red-brown. Average sizes are as follows:</u> <u>Weight: 10.8 grans</u> <u>Length: 7.2mm</u> <u>Claw: 3.1 mm</u> _____ _____ _____ _____ General Comments: <u>Samples collected on 5/9/01 and traps were rebaited due to low specimen numbers.</u> <u>URS returned on 6/19/1 to retrieve traps again. Specimens were removed from traps, measured, wrapped in acetone-rinsed foil, triple-bagged, and placed on ice.</u> _____

## FIELD SAMPLING DATA SHEET

Sample Type: <u>Invertebrate - Tissue</u>	Sample Number: <u>0105031W27TS</u>	Date: <u>5/9/01 &amp; 6/19/01</u>
Project: <u>Bradford Island</u>	Project Number: <u>52-00080001.00</u>	Task: <u>00004</u>
Weather Conditions: <u>Sunny</u>	Sample Matrix: <u>Tissue (Crayfish)</u>	
		Comments: _____

PID/FID Backgd: <u>N/A / N/A</u> ppm Head Space <u>N/A / N/A</u> ppm  P.I.D/FID Calibration Standard: <u>N/A</u> P.I.D./FID Calibration Date : <u>N/A</u> Soil Type: (USCS) <u>N/A</u> Description: <u>See Invertebrate Sample observations below.</u> _____ _____ _____ _____ _____ _____ _____ _____ Decontamination Method: <u>N/A</u> _____ _____	Sample Location: <u>Pile #2</u>  Sample Depth: <u>Various – collected throughout pile</u> Sample Time: <u>Various – samples collected on 5/9/01 &amp; 6/19/01</u> No. of Sample Containers: <u>1 resealable bag</u> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th colspan="2" style="text-align: center;">Analyses</th> </tr> </thead> <tbody> <tr><td style="width: 50%;">3.</td><td style="width: 50%;">2.</td></tr> <tr><td>5.</td><td>4.</td></tr> <tr><td>7.</td><td>6.</td></tr> <tr><td>9.</td><td>8.</td></tr> </tbody> </table> Other Field Measurements: <u>Measured claw length,</u> <u>abdomen length &amp; weight.</u> QA/QC samples: <u>QA sample sent to USACE lab by Battelle</u> <u>Laboratory.</u> Sampling Method: <u>Baited (with canned tuna) crayfish traps.</u> Grab: <u>X</u> Composite: _____ Sampler (s): <u>B.P. McNamara, M. Novak, C.Moody</u> Signature: _____	Analyses		3.	2.	5.	4.	7.	6.	9.	8.
Analyses											
3.	2.										
5.	4.										
7.	6.										
9.	8.										

Water Quality Observations: <u>N/A</u> _____ _____ _____ _____
Invertebrate Sample Observations: <u>Collected 17 total crayfish (pacifastacus sp.). Specimens were dark red-brown. Average sizes are as follows:</u> <u>Weight: 20.2 grams</u> <u>Length: 9.0 mm</u> <u>Claw: 4.5 mm</u> _____ _____
General Comments: <u>Samples collected on 5/9/01 and traps were rebaited due to low specimen numbers. URS</u> <u>returned on 6/19/1 to retrieve traps again. Specimens were removed from traps, measured, wrapped in acetone-rinsed foil,</u> <u>triple-bagged, and placed on ice.</u> _____

## FIELD SAMPLING DATA SHEET

Sample Type: <u>Invertebrate - Tissue</u>	Sample Number: <u>0105031W29TS</u>	Date: <u>5/9/01 &amp; 6/19/01</u>
Project: <u>Bradford Island</u>	Project Number: <u>52-00080001.00</u>	Task: <u>00004</u>
Weather Conditions: <u>Sunny</u>	Sample Matrix: <u>Tissue (Crayfish)</u>	
	Comments: _____	

PID/FID Backgd: <u>N/A / N/A</u> ppm Head Space <u>N/A / N/A</u> ppm  P.I.D/FID Calibration Standard: <u>N/A</u> P.I.D./FID Calibration Date : <u>N/A</u> Soil Type: (USCS) <u>N/A</u> Description: <u>See Invertebrate Sample observations below.</u>          Decontamination Method: <u>N/A</u>    	Sample Location <u>Background – Goose Island</u>  Sample Depth: <u>Various – collected throughout pile</u> Sample Time: <u>Various – samples collected on 5/9/01 &amp; 6/19/01</u> No. of Sample Containers: <u>1 resealable bag</u>  <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="2" style="text-align: center;">Analyses</th> </tr> </thead> <tbody> <tr> <td style="width: 50%;">4.</td> <td style="width: 50%;">2.</td> </tr> <tr> <td>6.</td> <td>4.</td> </tr> <tr> <td>8.</td> <td>6.</td> </tr> <tr> <td>10.</td> <td>8.</td> </tr> </tbody> </table> Other Field Measurements: <u>Measured claw length, abdomen length &amp; weight.</u> QA/QC samples: <u>None.</u> Sampling Method: <u>Baited (with canned tuna) crayfish traps.</u> Grab: <u>X</u> Composite: _____ Sampler (s): <u>B.P. McNamara, M. Novak, C.Moody</u> Signature: _____	Analyses		4.	2.	6.	4.	8.	6.	10.	8.
Analyses											
4.	2.										
6.	4.										
8.	6.										
10.	8.										

Water Quality Observations: N/A

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Invertebrate Sample Observations:

Collected 3 total crayfish (pacifastacus sp.). Specimens were dark red-brown. Average sizes are as follows:

Weight: 28.8 grams

Length: 9.7 mm

Claw: 3.4 mm

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General Comments: Samples collected on 5/9/01 and traps were rebaited due to low specimen numbers. URS  
returned on 6/19/1 to retrieve traps again. Specimens were removed from traps, measured, wrapped in acetone-rinsed foil,  
triple-bagged, and placed on ice.

## FIELD SAMPLING DATA SHEET

Sample Type: <u>Invertebrate - Tissue</u>	Sample Number: <u>0105031W26TS</u>	Date: <u>5/9/01 &amp; 6/19/01</u>
Project: <u>Bradford Island</u>	Project Number: <u>52-00080001.00</u>	Task: <u>00004</u>
Weather Conditions: <u>Sunny</u>	Sample Matrix: <u>Tissue (Crayfish)</u>	
		Comments: _____

<p>PID/FID Backgd: <u>N/A / N/A</u> ppm</p> <p>Head Space <u>N/A / N/A</u> ppm</p> <p>P.I.D/FID Calibration Standard: <u>N/A</u></p> <p>P.I.D./FID Calibration Date : <u>N/A</u></p> <p>Soil Type: (USCS) <u>N/A</u></p> <p>Description: <u>See Invertebrate Sample observations below.</u></p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>Decontamination Method: <u>N/A</u></p> <p>_____</p> <p>_____</p>	<p>Sample Location: <u>Pile #2</u></p> <p>_____</p> <p>Sample Depth: <u>Various – collected throughout pile</u></p> <p>Sample Time: <u>Various – samples collected on 5/9/01 &amp; 6/19/01</u></p> <p>No. of Sample Containers: <u>3 resealable bags</u></p> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th colspan="2" style="text-align: center;">Analyses</th> </tr> </thead> <tbody> <tr> <td style="width: 50%;">5.</td> <td style="width: 50%;">2.</td> </tr> <tr> <td>7.</td> <td>4.</td> </tr> <tr> <td>9.</td> <td>6.</td> </tr> <tr> <td>11.</td> <td>8.</td> </tr> </tbody> </table> <p>Other Field Measurements: <u>Measured claw</u> <u>length, abdomen length &amp; weight.</u></p> <p>QA/QC samples: <u>MS/MSD, Duplicate 010509IW30TS</u></p> <p>Sampling Method: <u>Baited (with canned tuna) crayfish traps.</u></p> <p>Grab: _____ Composite: <u>X</u></p> <p>Sampler (s): <u>B.P. McNamara, M. Novak, C.Moody</u></p> <p>Signature: _____</p>	Analyses		5.	2.	7.	4.	9.	6.	11.	8.
Analyses											
5.	2.										
7.	4.										
9.	6.										
11.	8.										

<p>Water Quality Observations: <u>N/A</u></p> <p>_____</p> <p>_____</p> <p>_____</p>
<p>Invertebrate Sample Observations:</p> <p><u>Collected 33 total crayfish (pacifastacus sp.). Specimens were dark red-brown. Average sizes are as follows:</u></p> <p><u>Weight: 18.2 grams</u></p> <p><u>Length: 71.5 mm</u></p> <p><u>Claw: 35.1 mm</u></p> <p>_____</p> <p>_____</p> <p>_____</p>
<p>General Comments: <u>Samples collected on 5/9/01 and traps were rebaited due to low specimen numbers.</u></p> <p><u>URS returned on 6/19/1 to retrieve traps again. Specimens were removed from traps, measured, wrapped in acetone-rinsed foil, triple-bagged, and placed on ice.</u></p> <p>_____</p>



## FIELD SAMPLING DATA SHEET

Sample Type: <u>SPMD</u>	Sample Number: <u>010619RQ01</u>	Date: <u>6/19/01</u>
Project: <u>Bradford Island</u>	Project Number: <u>52-00080001.00</u>	Task: <u>00004</u>
Weather Conditions: <u>Sunny</u>	Sample Matrix: <u>Semipermeable Membrane Device</u>	
		Comments: _____

PID/FID Backgd: <u>N/A / N/A</u> ppm Head Space <u>N/A / N/A</u> ppm _____ P.I.D/FID Calibration Standard: <u>N/A</u> P.I.D./FID Calibration Date : <u>N/A</u> Soil Type: (USCS) <u>N/A</u> Description: <u>Semipermeable Membrane Device</u> _____ _____ _____ _____ _____ _____ _____ _____ Decontamination Method: <u>N/A</u> _____ _____	Sample Location: <u>Pile #2 - West Perimeter</u> _____ Sample Depth: _____ Sample Time: <u>1400</u> No. of Sample Containers: <u>1 Canister</u> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th colspan="2" style="text-align: center;">Analyses</th> </tr> </thead> <tbody> <tr> <td style="width: 50%;">6.</td> <td style="width: 50%;">2.</td> </tr> <tr> <td>8.</td> <td>4.</td> </tr> <tr> <td>10.</td> <td>6.</td> </tr> <tr> <td>12.</td> <td>8.</td> </tr> </tbody> </table> Other Field Measurements: _____ _____ QA/QC samples: <u>Quality Assurance Sample</u> Sampling Method: <u>2 week deployment in river attached to anchor/buoy system</u> Grab: _____ Composite: <u>X</u> Sampler (s): <u>B.P. McNamara, M. Novak, C.Moody</u> Signature: _____	Analyses		6.	2.	8.	4.	10.	6.	12.	8.
Analyses											
6.	2.										
8.	4.										
10.	6.										
12.	8.										

Water Quality Observations: <u>N/A</u> _____ _____ _____ _____ _____ Invertebrate Sample Observations: _____ _____ _____ _____ _____ _____ General Comments: <u>Medium Biofouling (green brown organic file) on SPMD.</u> <u>Quality Assurance Sample sent to USACE Laboratory by Battelle Laboratory</u>
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## FIELD SAMPLING DATA SHEET

Sample Type: <u>SPMD</u>	Sample Number: <u>010619RQ05</u>	Date: <u>6/19/01</u>
Project: <u>Bradford Island</u>	Project Number: <u>52-00080001.00</u>	Task: <u>00004</u>
Weather Conditions: <u>Sunny</u>	Sample Matrix: <u>Semipermeable Membrane Device</u>	
	Comments: _____	

PID/FID Backgd: <u>N/A / N/A</u> ppm Head Space <u>N/A / N/A</u> ppm  P.I.D/FID Calibration Standard: <u>N/A</u> P.I.D./FID Calibration Date : <u>N/A</u> Soil Type: (USCS) <u>N/A</u> Description: <u>Semipermeable Membrane Device</u>         Decontamination Method: <u>N/A</u>	Sample Location: <u>Pile #1</u>  Sample Depth: _____ Sample Time: <u>1535</u> No. of Sample Containers: <u>1 Canister</u>  <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="2" style="text-align: center; padding: 5px;">Analyses</th> </tr> </thead> <tbody> <tr> <td style="width: 50%; padding: 5px;">7.</td> <td style="width: 50%; padding: 5px;">2.</td> </tr> <tr> <td style="padding: 5px;">9.</td> <td style="padding: 5px;">4.</td> </tr> <tr> <td style="padding: 5px;">11.</td> <td style="padding: 5px;">6.</td> </tr> <tr> <td style="padding: 5px;">13.</td> <td style="padding: 5px;">8.</td> </tr> </tbody> </table> Other Field Measurements: _____  QA/QC samples: _____ Sampling Method: <u>2 week deployment in river attached to anchor/buoy system</u> Grab: _____ Composite: <u>X</u> Sampler (s): <u>B.P. McNamara, M. Novak, C.Moody</u> Signature: _____	Analyses		7.	2.	9.	4.	11.	6.	13.	8.
Analyses											
7.	2.										
9.	4.										
11.	6.										
13.	8.										

Water Quality Observations: <u>N/A</u>	
Invertebrate Sample Observations:	
General Comments: <u>Medium Biofouling (green brown organic film) on SPMD.</u>	

## FIELD SAMPLING DATA SHEET

Sample Type: <u>SPMD</u>	Sample Number: <u>010619RQ06</u>	Date: <u>6/19/01</u>
Project: <u>Bradford Island</u>	Project Number: <u>52-00080001.00</u>	Task: <u>00004</u>
Weather Conditions: <u>Sunny</u>	Sample Matrix: <u>Semipermeable Membrane Device</u>	
	Comments: _____	

[illegible]

Water Quality Observations: N/A

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Invertebrate Sample Observations:

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General Comments: Low Biofouling (green brown organic film) on SPMD.

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## FIELD SAMPLING DATA SHEET



Sample Type: <u>SPMD</u>	Sample Number: <u>010619RQ02</u>	Date: <u>6/19/01</u>
Project: <u>Bradford Island</u>	Project Number: <u>52-00080001.00</u>	Task: <u>00004</u>
Weather Conditions: <u>Sunny</u>	Sample Matrix: <u>Semipermeable Membrane Device</u>	
		Comments: _____

PID/FID Backgd: <u>N/A / N/A</u> ppm Head Space <u>N/A / N/A</u> ppm  P.I.D/FID Calibration Standard: <u>N/A</u> P.I.D./FID Calibration Date : <u>N/A</u> Soil Type: (USCS) <u>N/A</u> Description: <u>Semipermeable Membrane Device</u>         Decontamination Method: <u>N/A</u>   	Sample Location: <u>Pile #2</u>  Sample Depth: _____ Sample Time: <u>1600</u> No. of Sample Containers: <u>1 Canister</u>  <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="2" style="text-align: center;">Analyses</th> </tr> </thead> <tbody> <tr> <td style="width: 50%;">9.</td> <td style="width: 50%;">2.</td> </tr> <tr> <td>11.</td> <td>4.</td> </tr> <tr> <td>13.</td> <td>6.</td> </tr> <tr> <td>15.</td> <td>8.</td> </tr> </tbody> </table> Other Field Measurements: _____  QA/QC samples: <u>Field Blank, Field /Duplicate</u> Sampling Method: <u>2 week deployment in river attached to anchor/buoy system</u> Grab: _____ Composite: <u>X</u> Sampler (s): <u>B.P. McNamara, M. Novak, C.Moody</u> Signature: _____	Analyses		9.	2.	11.	4.	13.	6.	15.	8.
Analyses											
9.	2.										
11.	4.										
13.	6.										
15.	8.										

Water Quality Observations: <u>N/A</u>     
Invertebrate Sample Observations:        
General Comments: <u>Medium Biofouling (green brown organic film) on SPMD.</u>  <u>Field Duplicate: 010619RQ03, Field Blank: 010619RQ04</u>





<b>Client Name:</b>  USACE		<b>Site Location:</b> Bradford Island Landfill, In-Water Investigation	<b>Project No.</b> 52-00080001.04
<b>Photo No.</b> 2.4-1	<b>Date:</b> May-01		
<b>Direction Photo Taken:</b>  Southwest			
<b>Description:</b>  Goose Island: Background Sampling Location			

<b>Photo No.</b> 2.4-2	<b>Date:</b> May-01	
<b>Direction Photo Taken:</b>  South		
<b>Description:</b>  Goose Island: Background Sampling Location SPMD Anchor and Crayfish Traps		



<b>Client Name:</b>  USACE		<b>Site Location:</b> Bradford Island Landfill, In-Water Investigation	<b>Project No.</b> 52-00080001.04
<b>Photo No.</b> 2.5-1	<b>Date:</b> May-01		
<b>Direction Photo Taken:</b>  Not Applicable			
<b>Description:</b>  Clams ( <i>Corbicula</i> sp.)			

<b>Photo No.</b> 2.5-2	<b>Date:</b> May-01	
<b>Direction Photo Taken:</b>  Not Applicable		
<b>Description:</b>  Crayfish		







## PHOTOGRAPHIC LOG



<b>Client Name:</b>  USACE		<b>Site Location:</b> Bradford Island Landfill, In-Water Investigation	<b>Project No.</b> 52-00080001.04
<b>Photo No.</b> 2.6-1	<b>Date:</b> Mar-01		
<b>Direction Photo Taken:</b> South			
<b>Description:</b> Sandblast Building Drain Catch Basin #1			


<b>Photo No.</b> 2.6-2	<b>Date:</b> Mar-01		
<b>Direction Photo Taken:</b> North			
<b>Description:</b> Sandblast Building Drain Catch Basin #1			



<b>Client Name:</b>		<b>Site Location:</b>	<b>Project No.</b>
 USACE		Bradford Island Landfill, In-Water Investigation	52-00080001.04
<b>Photo No.</b> 2.6-3	<b>Date:</b> Mar-01		
<b>Direction Photo Taken:</b>			
South			
<b>Description:</b>			
Sandblast Building Drain Catch Basin #2			

<b>Photo No.</b> 2.6-4	<b>Date:</b> May-01	
<b>Direction Photo Taken:</b>		
South		
<b>Description:</b>		
Sandblast Building Drain Catch Basin #2		



<b>Client Name:</b>		<b>Site Location:</b>	<b>Project No.</b>
 USACE		Bradford Island Landfill, In-Water Investigation	52-00080001.04
<b>Photo No.</b> 2.6-5	<b>Date:</b> Mar-01		
<b>Direction Photo Taken:</b>			
Southwest			
<b>Description:</b>			
Sandblast Building Drain Outfall #1.			

<b>Photo No.</b> 2.6-6	<b>Date:</b> May-01		
<b>Direction Photo Taken:</b>			
Southwest			
<b>Description:</b>			
Diver's Bubbles. Sediment sampling under Sandblast Building Drain Outfall #1.			

<b>Client Name:</b>  USACE		<b>Site Location:</b> Bradford Island Landfill, In-Water Investigation	<b>Project No.</b> 52-00080001.04
<b>Photo No.</b> 2.4-3	<b>Date:</b> May-01		
<b>Direction Photo Taken:</b>  Northwest			
<b>Description:</b>  Upstream Debris Pile SPMD Anchors and Crayfish Traps			

<b>Photo No.</b> 2.4-4	<b>Date:</b> May-01	
<b>Direction Photo Taken:</b>  Southeast		
<b>Description:</b>  Downstream Debris Pile #2 SPMD Anchors and Crayfish Traps		



## **VOLATILE ORGANIC COMPOUND ANALYSES - U.S. EPA SW-846, Method 8260B.**

Volatile organic compound (VOC) analyses were performed by Sound Analytical Services, Inc. (SAS) of Tacoma, Washington, in accordance with the requirements of the *Sampling and Analysis Plan, In-Water Investigation, Bradford Island Landfill*, April 2001 (URS) and referenced SOPs. The analytical SOP is equivalent to and referenced as EPA SW-846 Method 8260B for analysis of purgeable organic compounds.

Three catch basin sediments were analyzed for volatile organics, which includes two primary sample locations and one blind duplicate. Sample results are presented with associated data qualifiers in Table 4-14.

**Sample Documentation, Custody and Holding Conditions / Times:** All samples were handled and delivered to the laboratory according to chain-of-custody procedure. Laboratory data deliverables are well organized and complete. Maximum holding times are specified as 14 days at 4° C. ( $\pm 2^\circ$  C.) for solids. Upon receipt at the laboratory, transport cooler temperatures ranged from 4 to 6.2 °C. Holding conditions and times are determined to be acceptable. No results require qualification due to holding times and conditions.

**GC/MS Tuning:** GC/MS tune performance was checked with Bromofluorobenzene (BFB) prior to analysis of project samples. All sample analyses were performed within 12 hours of BFB analyses. All ion abundances and relative ion abundances meet method requirements. Review of mass spectral plots and associated mass listings supplied with the raw data shows no inconsistencies or errors. (Note: Instrument I.D. is not presented on documentation. It is assumed that the same instrument was employed for these analyses.)

**Initial Calibration:** The laboratory performed initial multipoint calibration at 0.4, 0.8, 2.0, 5.0, 10, and 20  $\mu\text{g/kg}$  for all target analytes. Surrogate compounds were only analyzed at 5.0  $\mu\text{g/kg}$  in each calibration run. Average Relative Response Factors (Average RRFs) are specified to be  $\pm 0.05$ , and Relative Standard Deviations (RSDs) must be  $\leq 15\%$  for volatile Target Compound List (TCL) analytes. Average RRFs are  $\pm 0.05$  for all TCL analytes in the initial calibration (performed on May 11, 2001; just prior to sample analyses) with the exception of acetonitrile and 2-butanone (Average RRF = 0.015 & 0.024, respectively). Acetonitrile is not a project target analyte, and 2-butanone was reported in all samples. Analytes with associated positive results and with RSDs  $> 15\%$  include 2-butanone, acetone, and bromomethane (RSD = 25%, 52% & 18%, respectively). Associated results are consequently qualified as estimates with a "J" qualifier code.

A 0.2  $\mu\text{g/kg}$  linearity verification check was run for all target analytes prior to sample analyses. All target analytes exhibited acceptable response, with the exception of the ketones, which requires qualification of all ketone results less than 0.4  $\mu\text{g/kg}$  as estimated ("J" qualifier code).

**Continuing Calibration:** Continuing calibration checks were performed prior to and following sample analyses (@ 2.0  $\mu\text{g/kg}$  for target analytes and 5.0  $\mu\text{g/kg}$  for surrogates). Project specifications are RRF must be  $\pm 0.05$ , and Percent Differences (%Ds) must be  $\leq 25\%$  for volatile TCL analytes. RRFs are  $\pm 0.05$

for all compounds, with the exception of those analytes previously identified as deviant in the initial calibration. For analytes with associated positive results, %Ds are  $\leq 25\%$  in all continuing calibrations with the exception of acetone. Accordingly, all acetone results require qualification as estimates ("J" qualifier code).

**Blanks:** An analytical method blank was run prior to sample analyses. Detected analytes and associated concentrations are as follows:

bromomethane	0.6 µg/kg
iodomethane	0.8 µg/kg
vinyl acetate	450 µg/kg
2-butanone	4.3 µg/kg
toluene	0.2 µg/kg
bromoform	0.6 µg/kg

Method blank results are evaluated relative to project samples with associated positive hits. Positive results for bromomethane in 010504SBDS24SS, 010501SBMS01SS and 010501SBMS02SS, and 2-butanone in 010501SBMS01SS and 010501SBMS02SS are qualified as nondetects ("U") due to method blank performance.

No field or transport blanks were submitted from the field.

**Surrogate Compound Performance:** Surrogate compounds were added to each sample prior to analysis to assess analytical performance on each sample. The surrogate compounds  $d_8$ -toluene, bromofluorobenzene,  $d_{10}$ -ethylbenzene, fluorobenzene, and dibromofluoromethane have the following acceptable recovery ranges for solids:  $d_8$ -T (91-109%), BFB (80-113%),  $d_{10}$ -EB (0-106%), FB (85-115%), and DBFM (75-115%). Surrogate performances were within acceptable ranges, with the exception of a slightly high recovery (119%) in 010501SBMS02SS. No results require qualification due to surrogate performance.

**Matrix Spike/Matrix Spike Duplicate Analyses:** One MS/MSD pair was analyzed for the sample delivery group, as specified. All TCL compounds were added to the samples, however only selected analytes were evaluated for determination of performance. MS/MSD performance is evaluated relative to the specifications of the USACE Shell for Analytical Chemistry. Control limits applied are from the Shell (70-130% recovery). Recoveries are all within the acceptable ranges, with the exception of toluene, which was not able to be evaluated due to a native level at a significantly higher concentration (24 µg/kg) than the spike level (2.7 µg/kg). MS/MSD performance is considered acceptable.

**Laboratory Control Samples:** A spiked blank (LCS) and LCS duplicate were analyzed with the sample delivery group. Recoveries for the same analytes evaluated in the MS/MSD analyses showed 89 - 113% for both LCS's at a spike level of 2 µg/kg. LCS performance is considered acceptable and the analytical systems are determined to be in control.

**TCL Compound Identification:** The relative retention times (RRTs) for all reported TCL compounds are within acceptance limits ( $\pm 0.06$  RRT units), and were all within 2 seconds of the expected retention

times. All mass spectra show good comparison with library reference spectra. Ion relative abundances on mass spectra for all reported compounds compare acceptably to library reference spectra. It is noted that the analyst failed to identify bromomethane in the method blank and yet correctly identified and reported it in the site samples. Bromomethane in the site samples are associated with lab background contamination and are consequently qualified as nondetects at the associated values ("U" qualifier code - see method blank, above).

**Compound Quantitation and Reported Detection / Quantitation Limits:** Reported quantitation or lower reporting limits are determined to be actual lower reporting limits with associated verifiable linear calibration points (no extrapolations observed). All reported concentrations less than the verifiable linear calibration range are appropriately qualified by the lab with the "J" code.

**System Performance:** Raw data show no indication of degradation of system performance during or between analytical runs. Reconstructed ion chromatograms (RICs) show no abrupt shifts in baseline, high background levels, excessive baseline rise with increased temperature, or other indications of system performance degradation.

A comparison of results from the analyses of split samples of 010501SBMS01SS by the project lab and a reference laboratory are summarized below:

Analyte	Project lab	Ref. lab
Dichlorodifluoromethane	0.51 U	10 U
Chloromethane	0.51 U	5.2 U
Vinyl chloride	0.51 U	5.2 U
Bromomethane	0.86 U	5.2 U
Chloroethane	0.51 U	10 U
Trichlorofluoromethane	0.51 U	5.2 U
Acetone	<b>59 J</b>	<b>22 J</b>
1,1-Dichloroethene	0.51 U	5.2 U
Methylene chloride	0.51 U	5.2 U
Carbon disulfide	<b>1.5</b>	5.2 U
<i>trans</i> -1,2-Dichloroethene	0.51 U	5.2 U
Vinyl acetate	2.5 U	52 U
1,1-Dichloroethane	0.51 U	5.2 U
2-Butanone	10 U	52 U
2,2-Dichloropropane	0.51 U	5.2 U
<i>cis</i> -1,2-Dichloroethene	0.51 U	5.2 U
Chloroform	0.51 U	5.2 U
Bromochloromethane	0.51 U	5.2 U
1,1,1-Trichloroethane	0.51 U	5.2 U
1,1-Dichloropropene	0.51 U	5.2 U
Carbon tetrachloride	0.51 U	5.2 U
1,2-Dichloroethane	0.51 U	5.2 U
Benzene	<b>0.94</b>	5.2 U
Trichloroethene	0.51 U	5.2 U



1,2-Dichloropropane	0.51 U	5.2 U
Bromodichloromethane	0.51 U	5.2 U
Dibromomethane	0.51 U	5.2 U
4-Methyl-2-pentanone	2.5 U	52 U
cis-1,3-Dichloropropene	0.51 U	5.2 U
Toluene	<b>24</b>	<b>17.1</b>
trans-1,3-Dichloropropene	0.51 U	5.2 U
2-Hexanone	2.5 U	52 U
1,1,2-Trichloroethane	0.51 U	5.2 U
1,3-Dichloropropane	0.51 U	5.2 U
Tetrachloroethene	<b>0.31 J</b>	5.2 U
Dibromochloromethane	0.51 U	5.2 U
1,2-Dibromoethane	0.51 U	5.2 U
Chlorobenzene	0.51 U	5.2 U
Ethylbenzene	<b>0.41 J</b>	5.2 U
1,1,1,2-Tetrachloroethane	0.51 U	5.2 U
meta-/para-Xylenes	<b>0.56 J</b>	5.2 U
ortho-Xylene	<b>0.30 J</b>	5.2 U
Styrene	0.51 U	5.2 U
Isopropylbenzene	0.51 U	5.2 U
Bromoform	0.51 U	5.2 U
1,1,2,2-Tetrachloroethane	0.51 U	5.2 U
1,2,3-Trichloropropane	0.51 U	5.2 U
n-Propylbenzene	0.51 U	5.2 U
Bromobenzene	0.51 U	5.2 U
1,3,5-Trimethylbenzene	<b>0.29 J</b>	5.2 U
2-Chlorotoluene	0.51 U	5.2 U
4-Chlorotoluene	0.51 U	5.2 U
tert-Butylbenzene	0.51 U	5.2 U
1,2,4-Trimethylbenzene	<b>0.40 J</b>	5.2 U
sec-Butylbenzene	0.51 U	5.2 U
p-Isopropyltoluene	<b>9.5</b>	<b>3.0 J</b>
1,3-Dichlorobenzene	0.51 U	5.2 U
1,4-Dichlorobenzene	0.51 U	5.2 U
n-Butylbenzene	0.51 U	5.2 U
1,2-Dichlorobenzene	0.51 U	5.2 U
1,2-Dibromo-3-chloropropane	0.51 U	26 U
1,2,4-Trichlorobenzene	0.51 U	26 U
Hexachlorobutadiene	0.51 U	26 U
Naphthalene	<b>0.70</b>	26 U
1,2,3-Trichlorobenzene	0.51 U	26 U

Results compare reasonably well, especially for a solid. Only two analytes exhibited detections above both labs' lower quantitation limits. Lower reporting limits varied by a factor of ten between the two labs.

**Field Replicates:** A blind field replicate sample pair was submitted and analyzed for VOCs for determination of analytical variability. Results for the pair are determined to be relatively comparable, with the exception of acetone and toluene, which showed 74% and 85% differences, respectively (59 / 27 µg/kg for acetone and 24 / 9.5 µg/kg for toluene). These deviations are not atypical of the variabilities observed for contaminated solids.

**Overall Assessment:** All deliverables required by the project are present and data packages are complete. Recommended sample holding times and conditions were met. GC/MS tuning requirements were met. Initial and continuing calibration performances are acceptable with some qualification of data. Method blank analysis showed some background contamination for detected target analytes. As a result, several associated sample results required qualification as not detected ("U"). Overall, surrogate compound recoveries are acceptable. MS/MSD and LCS performances were acceptable. Compound identification and quantitation are acceptable. Raw data show no indications of system performance degradation. Reported quantitation or lower reporting limits are verifiable and relatively low for these types of analyses. Replicate analysis was performed on one sample pair and showed typical performance for contaminated solids. Overall analytical performance is considered acceptable, and data quality is sufficient for project use.

**A summary of qualified results is as follows:**

Sample	Analyte	Value	Qualifier	Deviation
<b>010501SBMS01SS</b>	Bromomethane	0.86	U	Blank contamination
	Acetone	59	J	Initial calibration
	2-Butanone	10	J	Initial calibration
	Tetrachloroethene	0.31	J	< PQL
	Ethylbenzene	0.41	J	< PQL
	m,p-Xylene	0.56	J	< PQL
	o-Xylene	0.30	J	< PQL
	1,3,5-Trimethylbenzene	0.29	J	< PQL
	1,2,4-Trimethylbenzene	0.40	J	< PQL
<b>010501SBMS02SS</b>	Bromomethane	0.76	U	Blank contamination
	Acetone	27	J	Initial calibration
	2-Butanone	7.5	J	Initial calibration
	Ethylbenzene	0.4	J	< PQL
	m,p-Xylene	0.52	J	< PQL
	o-Xylene	0.26	J	< PQL
	Naphthalene	0.27	J	< PQL
<b>010504SBDS24SS</b>	Bromomethane	1.8	U	Blank contamination
	Acetone	130	J	Initial calibration
	2-Butanone	25	J	Initial calibration
	Benzene	0.58	J	< PQL

## PETROLEUM HYDROCARBON ANALYSES – WADOE NWTPH-HCID & NWTPH-Dx.

Petroleum hydrocarbon analyses were performed by Sound Analytical Services, Inc. (SAS) of Tacoma, Washington, in accordance with the requirements of the *Sampling and Analysis Plan, In-Water Investigation, Bradford Island Landfill*, April 2001 (URS) and referenced SOPs. The analytical SOPs are equivalent to and referenced as WADOE Northwest TPH-HCID and TPH-Dx (NWTPH-Dx [diesel range = C<sub>12</sub> - C<sub>24</sub> (as #2 diesel), lube or motor oil range = C<sub>24</sub> - C<sub>38</sub>]) - Semivolatile Petroleum Products Method for Soil and Water Analyses [with sulfuric acid and silica gel cleanup], as established by the Washington State Department of Ecology. NWTPH-HCID analyses were applied for screening with confirmatory results provided by NWTPH-Dx. NWTPH-HCID results indicated presence of diesel-range and lube-range hydrocarbons, with no gasoline range hydrocarbons greater than the lower reporting limits. This evaluation is performed for NWTPH-Dx only. No NWTPH-HCID evaluation is performed here. All NWTPH-Dx chromatograms were evaluated for determination of presence of specific or identifiable hydrocarbon mixtures. All bolded/highlighted values indicate the presence of the specific hydrocarbon mixture reported. Non-highlighted values represent presence of organics in the respective analytical range, but presence of a petroleum hydrocarbon mixture is determined to be improbable.

Five catch basin sediments were analyzed for diesel fuel and motor or lube oil hydrocarbons, which includes four primary sample locations and one blind duplicate. Sample results are presented with associated data qualifiers in Table 4-16.

**Sample Documentation, Custody and Holding Conditions / Times:** All samples were handled and delivered to the laboratory according to chain-of-custody procedure. Laboratory data deliverables are well organized and generally complete. Maximum holding times for petroleum hydrocarbons are specified as 14 /40 days (sample / extract maximum holding times) for solids at 4 °C. (±2 °C.). Upon receipt at the laboratory, transport cooler temperatures ranged from 4 to 6.2 °C. Holding conditions and times are determined to be acceptable. No results require qualification due to holding times and conditions.

**Initial Calibration:** The laboratory performed initial multipoint calibration (linearity verification) for #2 diesel fuel at 25, 50, 100, 250, 500, 1000, 2500 and 5000 µg/mL; and motor oil at 50, 100, 250, 500, 1000, 2500 and 5000 µg/mL (both on 4/20/02). Linearity for diesel was 8.1 RSD, and  $r^2 = 1.00$  for motor oil. Initial calibration levels, frequencies, and linearities are within pertinent guidance limits.

**Calibration Checks:** Calibration verifications were performed at concentrations of 1000 µg/mL for diesel and motor oil prior to and following sample runs, and at a frequency of every ten analyses. Criteria for passing are ± 15% from the initial calibration. %Diff were all ≤ 7%. No results required qualification based on out-of-compliance procedures and performance criteria.

**Blanks:** Two analytical method blanks were analyzed, as required. No analyte responses were reported for method blanks.

No field rinsate or transport blanks were submitted nor analyzed.

**Surrogate Compound Performance:** Surrogate compounds were added to each sample prior to analysis to assess analytical performance on each sample. The surrogate compounds for petroleum hydrocarbon analyses are 1-chlorooctane and o-terphenyl for diesel and motor oil. Surrogate performance is evaluated for o-terphenyl only with an acceptance range of 50-150% recovery. All recoveries are within specification.

**Matrix Spike/Matrix Spike Duplicate Analyses:** Three MS/MSD pairs were analyzed. Diesel and motor oil were added to selected samples for evaluation of MS/MSD performance at 620 -1260 mg/kg. Control limits applied are 50-150% recovery with a %D of less than 50%. Recoveries are all within the acceptance range. MS/MSD performance is considered acceptable.

**Laboratory Control Samples:** Two spiked blanks (LCSs) were analyzed. Both LCSs showed recoveries in the range of 95 - 119% for both diesel and motor oil. LCS spiking levels were 500 mg/kg. Performance is considered acceptable and the analytical systems are determined to be in control.

**Petroleum Hydrocarbon Mixture Identification:** Positive identifications of hydrocarbon mixtures are highlighted by applying bold-face type to the values reported in the attached table. No diesel hydrocarbons are identified, however four of the five samples showed presence of a lube-range mixture that could include hydraulic, dielectric and/or pump fluids.

**System Performance:** Raw data show no indication of degradation of system performance during or between analytical runs. Chromatograms show no abrupt shifts in baseline, high background levels, excessive baseline rise with increased temperature, or other indications of system performance degradation.

A comparison of results from the analyses of split samples by the project lab and an independent reference laboratory shows the following (mg/kg, dry):

	<u>010501SBMS01SS</u>		<u>010503IW14SS</u>	
	Project Lab	Ref. Lab	Project Lab	Ref. Lab
Diesel-range	130	100	61 U	10
Lube-range	<b>600</b>	<b>230</b>	120 U	50 U

Both labs identified lube oil in 01SS, and no recognizable petroleum product in 14SS.

**Field Replicates:** One blind field replicate sample pair was submitted and analyzed for petroleum hydrocarbons for determination of analytical variability. The duplicate pair showed comparable results.

**Overall Assessment:** All deliverables required by the project are present and data packages are complete. Recommended sample holding times and conditions were met. Initial calibration and calibration check requirements were met. Method blank performances were within specification. Surrogate compound recoveries are acceptable. MS/MSD and LCS performances are acceptable. Compound identification and quantitation are acceptable. Raw data show no indications of system performance degradation. Overall analytical performance is considered acceptable, and data quality is sufficient for project use.

## **SEMIVOLATILE ORGANICS ANALYSES - U.S. EPA SW-846, Method 8270C.**

Semivolatile organics analyses were performed by Sound Analytical Services, Inc. (SAS) of Tacoma, Washington, in accordance with the requirements of the *Sampling and Analysis Plan, In-Water Investigation, Bradford Island Landfill*, April 2001 (URS) and referenced SOPs. The analytical SOP is equivalent to and referenced as EPA SW-846 Method 8270C for analysis of acid, base and neutral extractable organic compounds. Extract preparations were performed in accordance with SW-846 Method 3550B.

Five river and five catch basin sediments were analyzed for semivolatile organics, which includes eight primary sample locations and two blind duplicates. Sample results are presented with associated data qualifiers in Tables 4-4 and 4-13.

**Sample Documentation, Custody and Holding Conditions / Times:** All samples were handled and delivered to the laboratory according to chain-of-custody procedure. Laboratory data deliverables are well organized and generally complete, with the exception of two missing initial calibration runs. A request to the lab for submission of missing documentation was made to complete the data package. Maximum holding times for extractables are specified as 14 /40 days (sample / extract maximum holding times) for solids at 4 °C. ( $\pm 2$  °C.). Upon receipt at the laboratory, transport cooler temperatures ranged from 4 to 6.2 °C. Holding conditions and times are determined to be acceptable. No results require qualification due to holding times and conditions.

**GC/MS Tuning:** GC/MS tune performance was checked with 2.5 ng decafluorotriphenylphosphine (DFTPP) prior to all initial calibrations runs and all subsequent sample analytical runs. All sample analyses were performed within 12 hours of DFTPP checks. All ion abundances and relative ion abundances meet method requirements. Review of mass spectral plots and associated mass listings supplied with the raw data show no inconsistencies or errors.

**Initial Calibration:** Initial multipoint calibrations were performed at 0.05, 0.1, 0.5, 1.0 and 2.5 µg/mL [on 5/3/01] and 0.1, 0.25, 0.5, 1.0, and 2.5 µg/mL [on 5/10/01] for all target analytes and surrogate compounds. Average Relative Response Factors (Average RRFs) must be  $\approx 0.01$ , and selected analytes must meet additional minimum RRF and maximum %RSD criteria. Average RRFs and %RSDs for all TCL compounds in all initial calibrations showed compliance with technical requirements.

**Continuing Calibration:** Continuing calibrations were performed for all TCL compounds at 1.0 ng/µL. RRFs must be  $\approx 0.01$ , and selected analytes must meet additional minimum RRF and maximum %Diff criteria ( $\leq 25\%$ ). All RRFs were in compliance with some deviation from criteria for %Diff. Noncompliant %Diff values did not affect sample results, since no positive detects were reported for the affected analytes.

**Blanks:** Analytical method blanks were analyzed at least once for each analytical group and matrix, as specified. Method blanks showed some detections of phthalates (butylbenzyl- & bis(2-

ethylhexyl)phthalate) above reporting limits. Reporting limits were adjusted upward for phthalates to minimize potential bias associated with background contamination.

**Surrogate Compound Performance:** Surrogate compounds (1.0 µg each or ~67 µg/kg, wet) were added to each solid sample prior to extraction to assess analytical performance on each sample. Surrogate compounds and associated performance criteria are those specified in the ACOE Shell for Analytical Chemistry (for solids). No results required qualification due to surrogate compound recovery performance. (It is noted that surrogate recoveries tended to be higher than normally observed for these types of analyses, and were generally greater than 100%. Recoveries ranged from 77% to 214% with a median greater than 100%).

**Matrix Spike/Matrix Spike Duplicate Analyses:** Matrix spike and matrix spike duplicate analyses were performed on three sediments. Analyte spike concentrations were 84, 91, and 170 µg/kg. MS/MSD recoveries were evaluated against the specifications in ACOE Shell for Analytical Chemistry. Recoveries ranged from 32% to 340%, even without the interference of native analytes in the extracts. Surrogate compound responses [recoveries] generally correlated with MS and MSD performances; typically greater than 100%. No results were qualified based on MS/MSD performance.

**Laboratory Control Samples:** Two spiked blanks (LCS) were analyzed for the solids analytical groups. LCS performance was compared to the specifications in the ACOE Shell for Analytical Chemistry. Spike concentrations were at an equivalent of 67 µg/kg. All recoveries were determined to be within acceptable range, generally averaged just less than 100%. LCS performance indicates the analytical systems are in control.

**TCL Compound Identification:** Relative retention times (RRTs) for most reported TCL compounds are acceptable ( $\pm 0.06$  RRT units or  $\pm 6$  seconds). Mass spectra, for some reported hits, show comparability with library reference spectra. Some target hits (potential positive identifications), such as 2,6-dinitrotoluene, N-nitrosodi-n-propylamine, and benzidine, were determined by the reviewer to be false positives. The 2,6-dinitrotoluene reports showed high interferences and noise across the baseline, a factor likely related to the use of an ITS40 (ion trap mass spectrometer) for analysis of "dirty" or busy extracts. The noise level/background is too high to determine presence at the reported values. The reported N-nitrosodi-n-propylamine is a poor mass spectral fit associated with an out-of-range retention time (+ 7 seconds relative to the calibration standard) and low signal to noise (S/N) response. The reports for benzidine are due to contributory ions (m/z 92 and 184) from the presence of a pentachlorobiphenyl isomer (a PCB constituent). Noise levels are sufficiently high for some PAHs to preclude the assignments made by the lab (for example, benzo(g,h,i)perylene in 010504SBDS24SS). The reported detection levels are generally lower than can be supported by the data. Spectral matches, in some cases, are marginal to poor. These values were replaced with appropriate nondetects ("U" qualified) for the analytes of concern. Benzo(b)fluoranthene and benzo(k)fluoranthene are insufficiently resolved chromatographically to report as distinguishable constituents. Caution should be exercised by the data user when interpreting results for these two analytes. A summation of results and use as a combined parameter (benzo(b+k)fluoranthenes) would be more appropriate.

**Compound Quantitation and Reported Detection / Quantitation Limits:** Lower reporting limits, in some cases, are lower than what can be verified by the reported data. The mass spectrometer used (an ion trap mass spectrometer - ITS40) is a very sensitive instrument prone to high background interferences when operated in an autogain mode. (The autogain function may have been engaged based on low S/N for some false positive assignments at significant reported concentrations [see N-nitrosodi-n-propylamine in 0105021IW14SS].) Essentially, the higher or more background the sample extract possesses (typical of sediments and soils), the more difficult it can be to identify presence of target analytes in the presence of interfering chemicals. Alternate instrumentations (such as quadrupolar, time of flight, or magnetic sector instruments) are better suited for analysis of complex extracts with high levels of interfering chemicals. Without documentation of mass spectrometer ionization times and autogain adjustment, detection limits may vary during an instrumental run without the knowledge of the analyst.

Lower reporting limits have been adjusted by the reviewer to concentrations equivalent to the lower limit of the initial calibrations (0.05 µg/mL). For some analytes (PAHs, in particular), the lab reported relatively low limits based on running a 0.01 µg/mL check standard. The 0.01 check standard is unverifiable in a complex sample extract. One-fifth of the surrogate concentrations (based on signal strength in extract runs) were determined to represent an average verifiable concentration for lower reporting limits for most analytes in each sample. These concentrations were also approximately equal to the equivalent level of the 0.05 µg/mL calibration standard. Consequently, lower reporting limits were adjusted by the reviewer to verifiable levels and not extrapolated or "clean extract" values.

Substituted anilines and phenols typically exhibit relatively low recoveries in environmental matrices. Most environmental analytical laboratories, including the reference laboratory, adjust their reported detection limits upward by factors of 10 or sometimes 20 for the difficult analytes relative to the "easy" analytes, such as PAHs. Practical quantitation levels (PQLs) should reflect the full sensitivity of the method and not extrapolated, or theoretical, limits. The project lab PQLs appear to be extrapolated and not verified PQLs. Note the differences in PQLs for the project lab compared to the reference laboratory for split samples below. Project lab PQLs should be considered unverified for analytes such as substituted phenols and anilines.

**System Performance:** The use of an ion trap mass spectrometer for the analysis of contaminated soils and sediments can result in the reporting of lower than actual quantitation/detection limits when the autogain function is engaged. This results in automatic, without necessarily the knowledge of the analyst, adjustment of instrumental sensitivities. This can result in variable and nonverifiable responses to target analytes (consistent with the results reported for MS/MSD and surrogate recovery performances) and higher than reported detection limits. The use of ion trap mass spectrometers, as they are currently available, is not recommended for analysis of contaminated solids without special extract cleanup procedures, which were not [reported to be] performed here. Consequently, the reported PQLs (practical quantitation limits) should be considered estimates, even those adjusted upward by the reviewer. The above recommendations and precautions are based on a review of reported mass spectral matches (and mismatches), false positive assignments, observation of high noise/background (low S/N) levels, and high surrogate and MS/MSD recovery variabilities.

A comparison of results from the analyses of split samples of 010501SBMS01SS and 010503IW14SS by the project lab and a reference laboratory are summarized below:

Analyte	010501SBMS01SS		010503IW14SS	
	Project lab	Ref. lab	Project lab	Ref. lab
Phenol	180 U	670 U	17 U	450 U
<i>bis</i> (2-Chloroethyl)ether	180 U	670 U	17 U	450 U
2-Chlorophenol	180 U	670 U	17 U	450 U
1,3-Dichlorobenzene	180 U	670 U	17 U	450 U
1,4-Dichlorobenzene	180 U	670 U	17 U	450 U
1,2-Dichlorobenzene	180 U	670 U	17 U	450 U
Benzyl alcohol	180 U	6700 U	17 U	4500 U
2-Methylphenol	180 U	670 U	17 U	450 U
2,2'-Oxy <i>bis</i> (1-chloropropane)	-	670 U	-	450 U
N-Nitrosodi-n-propylamine	180 U	670 U	42 U	450 U
Hexachloroethane	180 U	670 U	17 U	450 U
4-Methylphenol	<b>85 J</b>	<b>130 J</b>	17 U	450 U
Nitrobenzene	180 U	670 U	17 U	450 U
Isophorone	180 U	2000 U	17 U	1300 U
2-Nitrophenol	180 U	1300 U	17 U	890 U
2,4-Dimethylphenol	180 U	1300 U	17 U	890 U
<i>bis</i> (2-Chloroethoxy)methane	180 U	670 U	17 U	450 U
2,4-Dichlorophenol	180 U	670 U	17 U	450 U
Benzoic acid	450 U	6700 U	42 U	4500 U
1,2,4-Trichlorobenzene	180 U	670 U	17 U	450 U
Naphthalene	<b>27 J</b>	670 U	8 U	450 U
4-Chloroaniline	180 U	1300 U	17 U	890 U
Hexachlorobutadiene	180 U	670 U	17 U	450 U
4-Chloro-3-methylphenol	180 U	1300 U	17 U	890 U
2-Methylnaphthalene	180 U	670 U	8 U	450 U
Hexachlorocyclopentadiene	180 U	2700 U	17 U	1800 U
2,4,6-Trichlorophenol	180 U	670 U	17 U	450 U
2,4,5-Trichlorophenol	180 U	670 U	17 U	450 U
2-Chloronaphthalene	180 U	670 U	8 U	450 U
2-Nitroaniline	180 U	6700 U	17 U	4500 U
Acenaphthylene	<b>31 J</b>	670 U	8 U	450 U
Dimethylphthalate	180 U	670 U	17 U	450 U
2,6-Dinitrotoluene	180 U	670 U	17 U	450 U
3-Nitroaniline	180 U	6700 U	17 U	4500 U
Acenaphthene	<b>250</b>	<b>90 J</b>	8 U	450 U
2,4-Dinitrophenol	180 U	6700 U	17 U	4500 U
Dibenzofuran	<b>62 J</b>	670 U	17 U	450 U
4-Nitrophenol	180 U	6700 U	17 U	4500 U
2,4-Dinitrotoluene	180 U	670 U	17 U	450 U



Fluorene	<b>160</b>	670 U	8 U	450 U
Diethylphthalate	180 U	670 U	17 U	450 U
4-Chlorophenyl phenyl ether	180 U	670 U	17 U	450 U
4-Nitroaniline	180 U	6700 U	17 U	4500 U
4,6-Dinitro-2-methylphenol	450 U	6700 U	42 U	4500 U
N-Nitrosodiphenylamine	180 U	670 U	17 U	450 U
Hexachlorobenzene	180 U	670 U	17 U	450 U
4-Bromophenyl phenyl ether	180 U	670 U	17 U	450 U
Pentachlorophenol	180 U	6700 U	17 U	4500 U
Phenanthrene	<b>1100</b>	<b>470 J</b>	8 U	450 U
Anthracene	<b>290</b>	<b>90 J</b>	8 U	450 U
Di-n-butylphthalate	910 U	<b>120 JB</b>	84 U	<b>140 JB</b>
Fluoranthene	<b>2100</b>	<b>670</b>	8 U	450 U
Pyrene	<b>1900</b>	<b>750</b>	8 U	450 U
Butyl benzyl phthalate	180 U	670 U	17 U	450 U
Benzo(a)anthracene	<b>1000</b>	<b>330 J</b>	17 U	450 U
3,3'-Dichlorobenzidine	180 U	2700 U	17 U	1800 U
Chrysene	<b>1000</b>	<b>480 J</b>	8 U	450 U
bis(2-Ethylhexyl)phthalate	<b>3800</b>	<b>17200 B</b>	140 U	<b>220 JB</b>
Di-n-octylphthalate	180 U	<b>80 J</b>	17 U	450 U
Benzo(b)fluoranthene	<b>1700</b>	<b>690</b>	8 U	450 U
Benzo(k)fluoranthene	<b>370</b>	(b+k)	8 U	450 U
Benzo(a)pyrene	<b>1400</b>	<b>360 J</b>	8 U	450 U
Indeno(1,2,3-cd)pyrene	<b>640</b>	<b>240 J</b>	8 U	450 U
Dibenzo(a,h)anthracene	<b>180</b>	<b>80 J</b>	8 U	450 U
Benzo(g,h,i)perylene	<b>700</b>	<b>210 J</b>	8 U	450 U

Project lab results are generally greater than for the reference lab, which could be attributed to sample heterogeneity. The most notable difference between the two laboratory's data are the significantly lower detection limits reported by the project lab. Also, the project laboratory consistently reports lower reporting limits for "poor responders", such as substituted phenols and anilines, and other polars, at the same limits as for the higher responders, such as PAHs. The reference lab adjusts lower reporting limits for poor responders based on overall analytical system response, and not a theoretical or ideal limit.

**Field Replicates:** Blind field splits for two sediment pairs were submitted and analyzed for determination of analytical variability. Sample results for replicate pairs are presented in the attached results table. The sediment pairs showed typical variability for detected analytes in contaminated solids (variabilities up to 85% difference).

**Overall Assessment:** All deliverables required by the project are present and data packages are generally complete, with the exception of missing documentation for initial calibration runs performed on 5/10/01 that were later provided upon request, and mass spectrometer scan ionization times. Recommended sample holding times and conditions were met. GC/MS tuning requirements were met. Initial calibration requirements were generally met. Method blanks showed some low-level detections of

phthalates requiring the elevation of reporting limits for selected samples. Compound identification showed some false positives as noted above. Raw data shows some system performance degradation due to elevated noise levels, which interfered with the achievement of reported detection limits. Reported quantitation or lower reporting limits were adjusted upward for PAHs to verifiable levels. Lower reporting limits (detection limits) for many analytes are unverified; lower reporting limits for most of the polar analytes should be considered [gross] estimates and may be low by a factor of approximately 10. Overall analytical performance could be improved. The data as reported with associated qualifiers (following adjustments made by the reviewer) are adequate for project use.

A summary of qualified results is as follows:

Sample	Analyte	Value	Qualifier	Deviation
010501SBMS01SS	3- & 4-Methylphenol	85	J	< PQL
	Acenaphthylene	31	J	< PQL, nonverifiable
	2-Methylnaphthalene	180	U	PQL adjustment
	Dibenzofuran	62	J	< PQL
	2-Chloronaphthalene	180	U	PQL adjustment
	Di-n-butylphthalate	910	U	Blank contamination
	Benzidine	360	U	PQL adjustment
	Butylbenzylphthalate	180	U	Blank contamination
	Carbazole	190	J	< PQL
010501SBMS02SS	3- & 4-Methylphenol	69	J	< PQL
	Dibenzofuran	27	J	< PQL
	Fluorene	51	J	< PQL, nonverifiable
	2-Chloronaphthalene	170	U	PQL adjustment
	Acenaphthylene	170	U	PQL adjustment
	Butylbenzylphthalate	170	U	Blank contamination
	bis(2-Ethylhexyl)phthalate	2900	U	Blank contamination
	Carbazole	79	J	< PQL
010502IW01SS	2,6-Dinitrotoluene	16	U	False positive
	Diethylphthalate	16	U	Blank contamination
	2-Chloronaphthalene	8	U	PQL adjustment
	Acenaphthylene	8	U	PQL adjustment
	Acenaphthene	8	U	PQL adjustment
	Fluorene	8	U	PQL adjustment
	Anthracene	8	U	PQL adjustment
	Benzo(k)fluoranthene	8	U	PQL adjustment
	Di-n-butylphthalate	30	U	Blank contamination
	Butylbenzylphthalate	17	U	Blank contamination
	bis(2-Ethylhexyl)phthalate	42	U	Blank contamination
	Benzidine	16	U	False positive
010502IW07SS	3- & 4-Methylphenol	17	U	< PQL, nonverifiable
	2,6-Dinitrotoluene	17	U	False positive
	2-Chloronaphthalene	9	U	PQL adjustment
	Acenaphthylene	9	U	PQL adjustment

	Acenaphthene	9	U	PQL adjustment
	Fluorene	9	U	PQL adjustment
	Anthracene	9	U	PQL adjustment
	Benzo(k)fluoranthene	9	U	PQL adjustment
	Diethylphthalate	17	U	Blank contamination
	Di-n-butylphthalate	85	U	Blank contamination
	Butylbenzylphthalate	17	U	Blank contamination
	bis(2-Ethylhexyl)phthalate	190	U	Blank concentration
<b>010503IW14SS</b>	3- & 4-Methylphenol	17	U	< PQL, nonverifiable
	N-Nitrosodi-n-propylamine	42	U	False positive
	2,6-Dinitrotoluene	17	U	False positive
	2-Chloronaphthalene	8	U	PQL adjustment
	Acenaphthylene	8	U	PQL adjustment
	Acenaphthene	8	U	PQL adjustment
	Diethylphthalate	17	U	Blank contamination
	Fluorene	8	U	PQL adjustment
	Anthracene	8	U	PQL adjustment
	Di-n-butylphthalate	84	U	Blank contamination
	Fluoranthene	8	U	< PQL, nonverifiable
	Pyrene	8	U	< PQL, nonverifiable
	Butylbenzylphthalate	17	U	Blank contamination
	Chrysene	8	U	< PQL, nonverifiable
	bis(2-Ethylhexyl)phthalate	140	U	Blank contamination
	Benzo(k)fluoranthene	8	U	PQL adjustment
	Benzo(b)fluoranthene	8	U	< PQL, nonverifiable
<b>010503IW15SS</b>	3- & 4-Methylphenol	17	U	< PQL, nonverifiable
	2,6-Dinitrotoluene	17	U	False positive
	2-Chloronaphthalene	9	U	PQL adjustment
	Acenaphthylene	9	U	PQL adjustment
	Acenaphthene	9	U	PQL adjustment
	Diethylphthalate	17	U	Blank contamination
	Fluorene	9	U	PQL adjustment
	Phenanthrene	7	J	< PQL
	Anthracene	9	U	< PQL, nonverifiable
	Di-n-butylphthalate	87	U	Blank contamination
	Butylbenzylphthalate	17	U	Blank contamination
	Benzo(a)anthracene	7	J	< PQL
	Chrysene	7	J	< PQL
	bis(2-Ethylhexyl)phthalate	43	U	Blank contamination
	Benzo(k)fluoranthene	9	U	PQL adjustment
	Benzo(a)pyrene	5	J	< PQL
	Benzo(g,h,i)perylene	9	U	< PQL, nonverifiable
	Benzidine	70	U	False positive
<b>010503IW16SS</b>	2-Methylnaphthalene	8	U	< PQL, nonverifiable

	2-Chloronaphthalene	8	U	PQL adjustment
	Acenaphthylene	8	U	PQL adjustment
	2,6-Dinitrotoluene	16	U	False positive
	Acenaphthene	8	U	< PQL, nonverifiable
	Diethylphthalate	16	U	Blank contamination
	Fluorene	8	U	< PQL, nonverifiable
	Di-n-butylphthalate	78	U	Blank contamination
	Butylbenzylphthalate	20	U	Blank contamination
	bis(2-Ethylhexyl)phthalate	57	U	Blank contamination
	Benzo(b)fluoranthene	87		Sum of <i>b</i> & <i>k</i> isomers
	Benzo(k)fluoranthene			Unresolved from <i>b</i> isomer
<b>010503SBDS18SS</b>	2-Chloronaphthalene	170	U	PQL adjustment
	Acenaphthylene	170	U	PQL adjustment
	Acenaphthene	40	J	< PQL
	Dibenzofuran	83	U	< PQL, nonverifiable
	Fluorene	56	J	< PQL
	bis(2-Ethylhexyl)phthalate	2300	U	Blank contamination
	Benzo(b)fluoranthene	330		Sum of <i>b</i> & <i>k</i> isomers
	Benzo(k)fluoranthene			Unresolved from <i>b</i> isomer
	Indeno(1,2,3-cd)pyrene	80	J	< PQL
	Carbazole	71	J	< PQL
<b>010503SBDS19SS</b>	N-Nitrosodi-n-propylamine	40	U	False positive
	Naphthalene	6	J	< PQL
	2-Methylnaphthalene	9	U	< PQL, nonverifiable
	2-Chloronaphthalene	17	U	PQL adjustment
	2,6-Dinitrotoluene	17	U	False positive
	Dibenzofuran	9	J	< PQL
	Diethylphthalate	17	U	Blank contamination
	Di-n-butylphthalate	87	U	Blank contamination
	Butylbenzylphthalate	27	U	Blank contamination
	Carbazole	27	J	< PQL
<b>010504SBDS24SS</b>	2-Chloronaphthalene	340	U	PQL adjustment
	Acenaphthylene	170	U	PQL adjustment
	Acenaphthene	170	U	PQL adjustment
	Fluorene	170	U	PQL adjustment
	Phenanthrene	110	J	< PQL
	Benzo(a)anthracene	140	J	< PQL
	Benzo(k)fluoranthene	51	J	< PQL
	Benzo(a)pyrene	170	J	< PQL
	Indeno(1,2,3-cd)pyrene	34	J	< PQL
	Benzo(g,h,i)perylene	78	J	< PQL

## **BUTYL TINS ANALYSES - PSEP (Krone, et al.); GC/MS [full scan].**

Butyl tin analyses were performed by Sound Analytical Services, Inc. (SAS) of Tacoma, Washington, in accordance with the requirements of the *Sampling and Analysis Plan, In-Water Investigation, Bradford Island Landfill*, April 2001 (URS) and referenced SOPs. The analytical SOP is equivalent to and referenced as PSEP (Puget Sound Estuarine Protocols; Krone, et al. 1989) with full-scan GC/MS [ion trap MS] for analysis of butyl tin compounds (monobutyltin, dibutyltin, tributyltin and tetrabutyltin).

Five catch basin sediments and three sediment pore waters were analyzed for butyl tins, which includes six primary sample locations and two blind duplicates. Sample results are presented with associated data qualifiers in Table 4-17.

**Sample Documentation, Custody and Holding Conditions / Times:** All samples were handled and delivered to the laboratory according to chain-of-custody procedure. Laboratory data deliverables are well organized and generally complete, with the exception of the porewater preparation benchsheets, surrogate spectra, and derivative formation documentation (derivative types are not identified [inspection of mass spectra indicate that hexyl derivatives were employed]). Maximum holding times are specified as 14 / 40 days (sample / extract maximum holding times) for solids and 7 / 40 days for porewaters at 4 °C. ( $\pm 2$  °C.). Upon receipt at the laboratory, transport coolers temperatures ranged from 4 to 6.2 °C. Holding conditions and times are determined to be acceptable. No results require qualification due to holding times and conditions.

**GC/MS Tuning:** GC/MS tune performance was checked with 2.5 ng decafluorotriphenylphosphine (DFTPP) prior to all initial calibrations and all subsequent sample analytical runs. All sample analyses were performed within 12 hours of DFTPP checks. All ion abundances and relative ion abundances meet acceptance criteria. Review of mass spectral plots and associated mass listings supplied with the raw data show no inconsistencies or errors.

**Initial Calibration:** Initial multipoint calibration was performed at 1.0, 5.0, 10, 50, 100 and 200 ng/mL [on 5/16/01] for tetrabutyltin and at lower concentrations for the remaining analytes [80%, 77%, 58% and 41% for triphenyltin (surrogate), tributyltin, dibutyltin and monobutyltin, respectively]. Average Relative Response Factors (Average RRFs) ranged from 0.815 to 2.142, and %RSDs ranged from 5.9% to 18.4%. No performance criteria are available, however performance is considered reasonable and acceptable. No data was qualified based on calibration performance.

**Continuing Calibration:** Continuing calibrations were performed for all target analytes at the fifth calibration level (100 ng/mL tetrabutyltin and less for the other target analytes [see relative concentrations above]) prior to and following sample extract analyses. RRF %Diff's ranged from 0.5% to 18%. Performance is considered reasonable and acceptable.

**Blanks:** Three analytical method blanks were analyzed, two for solids and one for water matrices, as required. Method blanks showed no detections of target analytes above reporting limits.

**Surrogate Compound Performance:** A surrogate compound, triphenyl tin, was added to each sample (@ 1.1 µg) prior to extraction to assess analytical performance on each sample. Surrogate compound recoveries ranged from 71% to 137% in sediments and 55% to 75% in porewaters. Surrogate recovery performance is considered reasonable and acceptable.

**Matrix Spike/Matrix Spike Duplicate Analyses:** Matrix spike and matrix spike duplicate analyses were performed on a sediment and a porewater sample. Analyte spike concentrations were 0.178 - 0.286 µg/L for water and 114 - 183 µg/kg for sediment. MS/MSD recovery performances (as %R) are summarized as:

Analyte	Water		Sediment	
	Recovery	RPD	Recovery	RPD
tetrabutyltin	69 / 61	13	103 / 107	3.8
tributyltin	80 / 79	1.6	90 / 93	3.2
dibutyltin	40 / 41	1.2	74 / 79	6.4
monobutyltin	27 / 23	16	51 / 55	8.1

MS/MSD recoveries are typical for these types of analyses and are considered reasonable and acceptable. (Note that lower alkylated analogs exhibit lower recoveries, which is normal). No results were qualified based on MS/MSD performance.

**Laboratory Control Samples:** Two sets of spiked blanks (LCS) were analyzed, a set each for the solids and waters. Spike concentrations were at an equivalent of 0.12 - 0.2 µg/L and 83 - 133 µg/kg. Recoveries ranged from 29% to 92% in water and 73% to 115% in solids (TBT ranged from 67% to 88% for both matrices). Recoveries are determined to be within reasonable and acceptable ranges. LCS performances indicate the analytical systems are in control.

**Target Analyte(s) Identification:** Relative retention times (RRTs) for target compounds are within the CLP-specified acceptance limits ( $\pm 0.06$  RRT units or  $\pm 6$  seconds). Mass spectra show generally good comparability with library reference spectra. Some target analyte detections at low concentrations in water, for example dibutyltin in 010503SBDS18SS porewater, show marginal acceptance for mass spectral match and show an approximate S/N of 2. This indicates a practical lower quantitation limit of approximately 0.08 µg/L in water, and not 0.0073 and 0.0098, as indicated. Consequently, lower reporting limits have been adjusted upward due to inability to confidently identify target analytes at the lower reporting limits indicated.

**Compound Quantitation and Reported Detection / Quantitation Limits:** The laboratory reporting limits are lower than what can be verified from the data, particularly for waters. S/N is generally high enough to preclude identification and quantitation at the detection levels reported by the lab, especially for waters.

Lower reporting limits have been adjusted by the reviewer to concentrations that are estimated to demonstrate a S/N of 2-3 for detected analytes - this requires an upward adjustment of reporting limits by a factor of 4-5x (for example, 0.0052 µg/L has been adjusted to 0.02 µg/L [with one significant digit]). The lower reporting limit for tetrabutyltin in 010504SBDS24SS appears to not consider a dilution factor of

10x - thus the nondetect value has been adjusted from 3.4 µg/kg to 30 µg/kg [one significant digit]. Lower reporting limits should be considered estimates and have been adjusted by the reviewer to one significant digit (reported 1.7 has been adjusted to 2).

**System Performance:** System performance is considered generally acceptable. Major performance indicators are within acceptable limits. Lower quantitation limits (detection limits) are theoretical limits based on the absence of background and noise. Lower reporting limits have been adjusted upward to levels with a S/N of 2-3x.

No reference laboratory analyses of split samples were performed for comparison of results.

**Field Replicates:** Blind field splits for a sediment pair and a porewater pair were submitted and analyzed for determination of analytical variability. Sample results for replicate pairs are presented in the attached results table. Both pairs showed nondetects for all target analytes.

**Overall Assessment:** Most deliverables required by the project are present and data packages are generally complete, with the exception of missing documentation describing derivative formation (reaction and conditions), porewater preparation benchsheets, and some analyte spectra (surrogates and internal standards). Recommended sample holding times and conditions were met. GC/MS tuning requirements were met. Initial calibration requirements were met. Method blanks showed no detections. Reported quantitation or lower reporting limits were adjusted upward in many cases to verifiable levels. The data as reported with associated qualifiers (following adjustments made by the reviewer) are adequate for project use.

A summary of qualified results is as follows:

Sample	Analyte	Value	Qualifier	Deviation
010503SBDS18SS <i>pw</i>	Tributyl tin	0.04	U	PQL adjustment
	Tetrabutyl tin	0.04	U	PQL adjustment
010503SBDS19SS <i>pw</i>	All butyl tins	0.02	U	PQL adjustment
010503SBDS19SS <i>sed.</i>	Tetrabutyl tin	3	U	PQL adjustment
010503SBDS20SS <i>pw</i>	All butyl tins	0.02	U	PQL adjustment
010504SBDS24SS <i>sed.</i>	Tetrabutyl tin	30	U	PQL adjustment

## **CHLOROPHENOXY HERBICIDES ANALYSES - U.S. EPA SW-846, Method 8151A; GC/MS [full scan].**

Herbicides analyses were performed by Sound Analytical Services, Inc. (SAS) of Tacoma, Washington, in accordance with the requirements of the *Sampling and Analysis Plan, In-Water Investigation, Bradford Island Landfill*, April 2001 (URS) and referenced SOPs. The analytical SOP is equivalent to and referenced as SW-846 Method 8151A with full-scan GC/MS [ion trap MS] (applying some criteria from SW-846 Method 8270) for the analysis of chlorophenoxyherbicides, 4-nitrophenol and pentachlorophenol (PCP).

Five river sediments, which includes four primary sample locations and one blind duplicate. Sample results are presented with associated data qualifiers in Table 4-5.

**Sample Documentation, Custody and Holding Conditions / Times:** All samples were handled and delivered to the laboratory according to chain-of-custody procedure. Laboratory data deliverables are well organized and generally complete, with the exception of surrogate spectra and derivative formation documentation (derivative types are not identified [inspection of mass spectra indicate that methyl ester and ether derivatives were employed]). Maximum holding times are specified as 14 /40 days (sample / extract maximum holding times) for solids at 4 °C. ( $\pm 2$  °C.). Upon receipt at the laboratory, transport coolers temperatures ranged from 4 to 6.2 °C. Holding conditions and times are determined to be acceptable. No results require qualification due to holding times and conditions.

**GC/MS Tuning:** GC/MS tune performance was checked with 2.5 ng decafluorotriphenylphosphine (DFTPP) prior to all initial calibrations and all subsequent sample analytical runs. All sample analyses were performed within 12 hours of DFTPP checks. All ion abundances and relative ion abundances meet acceptance criteria. Review of mass spectral plots and associated mass listings supplied with the raw data show no inconsistencies or errors.

**Initial Calibration:** Initial multipoint calibration was performed at 0.01, 0.05, 0.1, 0.5, 1.0 and 2.0 µg/mL [on 4/9/01] for target analytes and surrogate (2,4-dichlorophenylacetic acid). Average Relative Response Factors (Average RRFs) ranged from 0.374 to 1.697, and %RSDs ranged from 3.4% to 11.2%. No performance criteria are available, however performance is considered reasonable and acceptable. No data was qualified based on calibration performance.

**Continuing Calibration:** Continuing calibrations were performed for all target analytes at 1.0 µg/mL prior to and following sample extract analyses. RRF %Diff's ranged from 0.1% to 18%. Performance is considered reasonable and acceptable.

**Blanks:** One analytical method blank was analyzed, as required. Method blank results showed no detections of target analytes above reporting limits.

**Surrogate Compound Performance:** A surrogate compound, 2,4-dichlorophenylacetic acid, was added to each sample (@ 10 µg) prior to extraction to assess analytical performance on each sample. Surrogate



compound recoveries ranged from 65% to 93% in sediments. Surrogate recovery performance is considered reasonable and acceptable.

**Matrix Spike/Matrix Spike Duplicate Analyses:** Matrix spike and matrix spike duplicate analyses were performed on one sediment sample. Analyte spike concentrations were 810 µg/kg. MS/MSD recovery performances (as %R) are summarized as:

Analyte	Recoveries	RPD
dalapon	35 / 23	44
dicamba	99 / 68	37
2,4-D	96 / 86	11
pentachlorophenol	103 / 90	13
2,4,5-TP (silvex)	88 / 81	7
dinoseb	80 / 77	3
MCPP	102 / 96	7

MS/MSD recoveries are considered reasonable and acceptable. Dalapon [low] recoveries can be attributed to higher vapor pressures of the analyte and losses from concentration steps. No results were qualified based on MS/MSD performance, since no analytes were detected in project samples.

**Laboratory Control Samples:** A spiked blank (LCS) was analyzed at a spike level equivalent to 670 µg/kg for the following target analytes:

dalapon	35%	dicamba	88%
2,4-D	88%	pentachlorophenol	92%
2,4,5-TP	90%	dinoseb	77%
MCPP	86%		

Dalapon exhibited the lowest recovery, consistent with MS/MSD performance. Recoveries are determined to be within reasonable and acceptable ranges. LCS performances indicate the analytical systems are in control.

**Target Analyte(s) Identification:** No target analytes are detected or reported in project sediments.

**Compound Quantitation and Reported Detection / Quantitation Limits:** Reported quantitation or lower reporting limits are based on the lowest verifiable calibration point and absence of any potential interferences and baseline noise. These lower limits may not be verifiable if ionization times are reduced due to background total ionization currents and the potential use of the autogain function. Lower quantitation limits should be considered estimates.

**System Performance:** System performance is considered generally acceptable. Major performance indicators are within acceptable limits. Lower quantitation limits (detection limits) are theoretical limits based on the absence of background and noise.

**Field Replicates:** A blind field split was submitted and analyzed for determination of analytical variability. Sample results are presented in the attached results table. Both samples showed nondetects for all target analytes.

**Overall Assessment:** Most deliverables required by the project are present and the data package is generally complete, with the exception of missing documentation describing derivative formation (reaction and conditions), and some analyte spectra (surrogates and internal standards). Recommended sample holding times and conditions were met. GC/MS tuning requirements were met. Initial calibration requirements were met. Method blanks showed no detections. Reported quantitation or lower reporting limits should be considered estimates. The data as reported are acceptable for project use.

## CHLORINATED PESTICIDES/PCBs ANALYSES in SEDIMENTS -

U.S. EPA SW-846, Methods 8081 & 8082.

Chlorinated pesticides and PCBs (Aroclors) analyses were performed by Sound Analytical Services, Inc. (SAS) of Tacoma, Washington, in accordance with the requirements of the *Sampling and Analysis Plan, In-Water Investigation, Bradford Island Landfill*, April 2001 (URS) and referenced SOPs. The analytical SOP is equivalent to and referenced as EPA SW-846 Method 8081 for analysis of chlorinated pesticides and Method 8082 for analysis of PCBs (as Aroclors) by GC/ECD. Supplied documentation shows no evidence of extract cleanups prior to instrumental analyses.

Nine river and five catch basin sediments, which includes seven primary sample locations and two blind duplicates. Sample results are presented with associated data qualifiers in Table 4-2.

**Sample Documentation, Custody and Holding Conditions / Times:** All samples were handled and delivered to the laboratory according to chain-of-custody procedure. Laboratory data deliverables are well organized and generally complete. Maximum holding times are specified as 14 /40 days (sample / extract maximum holding times) for solids at 4 °C. ( $\pm 2$  °C.). Upon receipt at the laboratory, transport coolers temperatures ranged from 4 to 6.2 °C. Holding conditions and times are determined to be acceptable. No results require qualification due to holding times and conditions.

**GC/ECD Instrument Performance Check:** DDT retention times showed less than 1% difference from a mean retention time of approximately 10.1 minutes on the primary column and approximately 10.6 minutes on the secondary or confirmatory column. DDT and endrin breakdown checks were performed every tenth run and prior to and following sample extract analyses. DDT and endrin breakdowns were less than 12% (specification is <20%) and averaged 4.2%. The integrity of the analytical system is within specification.

**Initial Calibration:** Six-point calibrations (1, 5, 10, 25, 50 & 75 ng/mL) were performed for pesticides [some analytes were calibrated at concentrations of x2 and methoxychlor at x10 of the above] (4/9/01) and five-point (0.01, 0.05, 0.1, 0.25 & 0.5 µg/mL) (5/15/01) for Aroclors 1221, 1242, 1254 and 1260 on a primary and confirmation (secondary) column. Three (A1221) and five (A1242, 1254 & 1260) target peaks were applied for identification and quantitation for each Aroclor. Evidence of calibration for toxaphene, Aroclors 1016, 1232 & 1248 was not included in the data package, however this may be unnecessary since these analytes were not observed in project samples. Linearity checks demonstrated individual analyte %RSDs to be within specification (specification  $\leq 20\%$ , with no more than two analytes exhibiting  $>30\%$ ) for pesticides. The mean RSD for the four Aroclors calibrated ranged from 9% to 22% for both columns. Initial calibrations were within acceptable limits.

**Continuing Calibration or Calibration Verification:** Individual pesticides mix (25 ng/mL) and Aroclors 1242 and 1260 calibration (0.1 µg/mL) checks were analyzed prior to and following every ten instrumental runs (within a 12-hour period). All analyte retention times were within the initial calibration retention time windows established above ( $\pm 2$  seconds on either side of the mean determined during initial calibrations). Continuing calibration responses were within the 25 RPD specification.

**Blanks:** Two method blanks were analyzed, one for each analytical group of 20 samples or less. No analytes were detected above the lower reporting limit.

No equipment rinsate blanks were submitted nor analyzed.

**Surrogate Compound Performance:** Surrogate compounds, tetrachloro-m-xylene (TCMX) and decachlorobiphenyl (DCBP), were added to each sample prior to analysis to assess analytical performance. Surrogate compound recovery specifications (lab-derived control limits) are:

Surrogate	Recovery acceptance ranges (%)	
	M.8081 (pesticides)	M.8082 (PCBs)
TCMX	34 - 143	52 - 131
DCBP	26 - 157	53 - 126

All surrogate recoveries are within the above specifications. No qualification of results are required for the reported data due to surrogate performance.

**Matrix Spikes/Matrix Spike Duplicates:** Matrix spike and matrix spike duplicate analyses were performed on two sediment samples. Analyte spike concentrations ranged from 26 µg/kg to 52 µg/kg for pesticides and 105 µg/kg to 240 µg/kg for Aroclor 1260. Pesticide MS/MSD recoveries were evaluated against the specifications in the U.S. EPA CLP Statement of Work OLM01.0-.8 (8/91). MS/MSD recovery specifications are:

Analyte	Recovery (%)	RPD
Gamma-BHC (lindane)	46 - 127	50
Heptachlor	35 - 130	31
Aldrin	34 - 132	43
Dieldrin	31 - 134	38
Endrin	42 - 139	45
4,4'-DDT	23 - 134	50

Pesticide MS/MSD performances were within specification. Aroclor 1260 recoveries are 156 / 181% (15 RPD) and 89 / 97% (9 RPD). No data required qualification due to MS/MSD performances.

**Laboratory Control Samples:** Two solid spiked blanks (LCSs) were analyzed; one LCS per analytical group. All LCS recoveries were within the acceptance ranges for the MS/MSDs, above. Spike concentrations varied from an equivalent 25 - 50 µg/kg for pesticides and 100 µg/kg (based on solid concentration) for Aroclor 1260. Aroclor 1260 recovery performance was 87 - 100%. All recoveries were determined to be within acceptable range. All recovery measurements are determined to be within specification, and the analytical systems are in control.

**Target Compound Identification:** All reported analyte identifications and concentrations were verified on a secondary or confirmation column. Assignments were determined to be valid within a  $\pm 0.003$  RRT window (compared to the continuing calibration runs) on both columns, and the concentrations were determined to be within 40% (on the two columns). Some analytes exhibited elevated reporting limits due to apparent chemical interference (the concentration comparabilities on the two columns showed high

variance from coeluting interferences). This is especially the case for pesticides when elevated PCBs are present. Some pesticide lower reporting limits were elevated due to interferences from PCBs (Aroclor patterns). Aroclor patterns were examined for evaluation of accuracy in assignments - identifications appear to be appropriate. Target analyte identifications were in compliance with method specifications.

**Compound Quantitation and Reported Detection / Quantitation Limits:** Reported quantitation or lower reporting limits are generally based on the lowest calibration standard concentration and no chromatographic interferences. Some lower reporting limits were raised by the reviewer when PCBs interfered with the determination of pesticides. This was especially for the case of DDE, dieldrin, endrin aldehyde and heptachlor epoxide in 010502IW14SS and 010502IW15SS (factors of 2-5x). Lower reporting limits were rounded to one significant digit by the reviewer, since the lower reporting limits should be considered estimates.

**Field Replicates:** Blind field splits for two sediment pairs were submitted and analyzed for determination of analytical variability. Sample results for replicate pairs are presented in the attached sample results table. Results are comparable and within the variabilities typical of contaminated solids.

**Overall Assessment:** Quality control performance indicators were all either acceptable or within specification. Holding times and conditions are within specification. Toxaphene and some Aroclors calibrations were not found in the data deliverables. Surrogate, MS/MSD and LCS recoveries are within specification. Calibrations and endrin/DDT breakdowns are within acceptable limits. Criteria for identifications and quantitations are acceptable. Some target analyte lower reporting limits were elevated due to interferences from Aroclor constituent peaks. Data quality is sufficient for project use.

A comparison of results from split sample analyses performed by an independent reference laboratory shows nondetects for pesticides by both labs for sediment sample 010503IW14SS. A comparison of Aroclors' results for the same sample ( $\mu\text{g/kg}$ , dry) is as follows:

<u>Analyte</u>	<u>Project Lab</u>	<u>Reference Lab</u>
Aroclor 1016	10 U	230 U
Aroclor 1221	21 U	230 U
Aroclor 1232	10 U	230 U
Aroclor 1242	10 U	230 U
Aroclor 1248	10 U	230 U
Aroclor 1254	<b>510</b>	<b>3970</b>
Aroclor 1260	10 U	230 U

A comparison of PCBs results for water sample 010503IW11WCS shows nondetects for both labs.

A summary of qualified results is as follows:

<u>Sample</u>	<u>Analyte</u>	<u>Value</u>	<u>Qualifier</u>	<u>Deviation</u>
<b>010502IW01SS</b>	DDT	1.7	J	< PQL
<b>010503IW14SS</b>	Dieldrin	10	U	Elevated background
	Endrin	4	U	Elevated background
	Endrin aldehyde	4	U	Elevated background
	Heptachlor epoxide	4	U	Elevated background

<b>010503IW15SS</b>	DDE	6	U	Elevated background
	Dieldrin	9	U	Elevated background
	Endrin	3	U	Elevated background
	Endrin aldehyde	5	U	Elevated background
	Heptachlor epoxide	3	U	Elevated background
<b>010503IW16SS</b>	DDD	0.8	J	< PQL
	DDE	0.5	J	< PQL
<b>010504SBDS24SS</b>	Aroclor 1260	18	J	< PQL

**PCBs (as Aroclors) ANALYSES in SEDIMENT, TISSUE and DISSOLVED and PARTICULATE WATER and SEMIPERMEABLE MEMBRANE DEVICES (SPMD)**  
- Battelle SOP MSL-O-009 / MSL-O-004.

PCBs (Aroclors) analyses were performed by Battelle/Marine Sciences Laboratory of Sequim, Washington, in accordance with the requirements of the *Sampling and Analysis Plan, In-Water Investigation, Bradford Island Landfill*, April 2001 (URS) and referenced SOPs. The analytical SOPs are referenced as Battelle SOP MSL-O-009, *Extraction and Clean-Up of Sediments and Tissues for Semivolatile Organics Following the Surrogate Internal Standard Method*, and MSL-O-004, *Analysis of Polychlorinated Biphenyls and Chlorinated Pesticides by Gas Chromatography with Electron Capture Detection*, which is based on EPA SW-846 Method 8081.

Twelve waters (six dissolved and six particulate phase waters), six river sediments, five clam composites, five crayfish composites, and five semipermeable membrane device ("fat bag") samples. Tissue concentrations are expressed normalized to wet weights, and sediments normalized to dry weights. Sample results are presented with associated data qualifiers in Tables 4-1, 4-9, and 4-10.

The analytical method reports results as recovery-corrected using the surrogates for correction. Internal standards are applied to determine surrogate recoveries for each sample. SPMD extracts were cleaned up by GPC, the water extracts required no clean up, and the sediment and tissue extracts were cleaned up by GPC and alumina chromatography.

Tissue composites consist of the following numbers of individuals:

<u>Clams</u>		<u>Crayfish</u>	
010502IW09TS	63	010509IW26TS	10
010502IW21TS	50	010509IW27TS	17
010502IW22TS	145	010509IW28TS	6
010502IW23TS	215	010509IW29TS	3
010502IW24TS	215 (split of above)	010509IW30TS	23

**Sample Documentation, Custody and Holding Conditions / Times:** All samples were handled and delivered to the laboratory according to chain-of-custody procedure. Laboratory data deliverables are generally well organized and complete. Maximum holding times are specified as 14 /40 days (sample / extract maximum holding times) for solids at 4 °C. ( $\pm 2$  °C.) or extended holding times of up to one year are acceptable at temperatures of -20 °C. Solids (sediments and tissues) were frozen upon receipt at the lab and extracted after approximately 60 days. Water holding times and conditions are specified as not to exceed 7 days (as unpreserved) at 4 °C until extraction and 40 days extract holding time. Upon receipt at the laboratory, transport coolers temperatures ranged from 1.4 to 5.8 °C. Holding conditions and times are determined to be acceptable. No results require qualification due to holding times and conditions.

**Initial Calibration:** Six-point calibrations (20, 50, 100, 200, 1000 & 5000 ng/mL) were performed for Aroclors 1248, 1254 and 1260 on a primary (DB-5) and confirmation (secondary, DB-17) column. A five-point calibration was performed for Aroclor 1242 (concentrations same as above minus the highest concentration [5000]). Initial calibration data was acquired over the period of 6/15 through 6/28. Ten to

fourteen target peaks were applied for identification and quantitation for each Aroclor on both GC columns. Quadratic fits were performed for each of the target peaks with  $R^2 > 0.995$ . Calibrations were established just prior to sample extract analyses. Initial calibrations were within acceptable limits.

**Continuing Calibration Verification:** Aroclor calibration checks (for the four mixtures identified above) were performed at 100 ng/mL just prior to and following the analysis of extracts of SPMDs and crayfish in July. RPDs were less than 30% for the analysis of crayfish and SPMD sample extracts; all within specification.

**Blanks:** Method blanks were analyzed for each analytical group and matrix type. No analytes were detected above the lower reporting limit.

**Surrogate Compound Performance:** Surrogate compounds, PCB congeners (BZ#) 103 and 198, were added to each sample (100 - 200 ng) prior to analysis to assess analytical performance and for recovery correction of reported Aroclors. Surrogate compound recovery specifications (lab-derived control limits) are 40 - 120%.

All surrogate recoveries are within the above specifications, with the exception of 010502IW03SS and 010509IW28TS which are greater than 120% (160-190%R). Sample results for 010502IW03SS and 010509IW28TS are considered estimates ("J" qualified) due to out-of-range surrogate recoveries. No other results required qualification due to surrogates performance.

**Matrix Spikes/Matrix Spike Duplicates:** Matrix spike and matrix spike duplicate analyses were performed on all matrices with the exception of SPMDs. Analyte spike concentrations ranged from 67 µg/kg to 100 µg/kg for Aroclor 1254 in the solid samples and 490 ng/L to 1000 ng/L in waters. The sediment and clam tissue spikes were not able to be evaluated due to native concentrations exceeding the spike levels. The crayfish spike showed a recovery of 120%, and the two water samples showed recoveries of 100% and 107%. MS/MSD recoveries are acceptable. No data required qualification due to MS/MSD performances.

**Laboratory Control Samples:** Spiked blanks (LCSs) were analyzed for each matrix type. Aroclor 1254 was spiked at the following levels: sediments = 67 µg/kg, tissues = 100 µg/kg, waters = 500 ng/L, and SPMDs = 1000 ng total. All LCS recoveries were within the range of 86% to 140%. All recoveries were determined to be within acceptable range. All recovery measurements are determined to be within specification, and the analytical systems are in control.

**Target Compound Identification:** All reported analyte identifications and concentrations were verified on the secondary or confirmation column. Concentrations were compared from the two columns and generally determined to be within 40% (on the two columns). Aroclor 1254 was always the PCB identified in all of the matrices and samples analyzed. Aroclor patterns were examined for evaluation of accuracy in assignments - identifications appear to be appropriate. Target analyte identifications were in compliance with method specifications.



**Compound Quantitation and Reported Detection / Quantitation Limits:** Reported quantitation or lower reporting limits are generally based on the lowest calibration standard concentration and no chromatographic interferences. Some lower reporting limits were raised by the reviewer when there was an apparent deviation from the use of the lowest calibration standard as the lower reporting limit.

**Field Replicates:** Blind field splits for two tissue samples, a water, a water plus particulate matter, a sediment, and an SPMD pair were submitted and analyzed for determination of monitoring variability. Sample results for replicate pairs are presented in the attached sample results table. Results are generally comparable and within the variabilities typical of contaminated materials. The water split showed especially good agreement, where the water plus particulates exhibited less agreement, as expected. Tissue and sediment pairs exhibited generally good agreement.

**Overall Assessment:** Quality control performance indicators were all either acceptable or within specification. Holding times and conditions are within specification. Surrogate, MS/MSD and LCS recoveries are within specification, with minor exceptions. Initial calibrations and calibration verifications are within acceptable limits. Criteria for identifications and quantitations are acceptable. Some target analyte lower reporting limits were elevated due to apparent deviations from protocol. Data quality is sufficient for project use.

A comparison of results from a split sample analysis (on 010503IW22TS, a clam homogenate) performed by an independent reference laboratory is as follows (µg/kg, wet):

<u>Analyte</u>	<u>Project Lab</u>	<u>Reference Lab</u>
Aroclor 1016	-	8 U
Aroclor 1221	-	8 U
Aroclor 1232	-	8 U
Aroclor 1242	14 U	8 U
Aroclor 1248	14 U	8 U
Aroclor 1254	<b>344</b>	<b>1522</b>
Aroclor 1260	14 U	8 U

A summary of qualified results is as follows:

<b>Sample</b>	<b>Analyte</b>	<b>Value</b>	<b>Qualifier</b>	<b>Deviation</b>
<b>010502IW03SS</b> <i>sed.</i>	Aroclor 1254	24000	J	Surrogate R > 120%
<b>010502IW04WCS</b> <i>water</i>	Aroclor 1254	0.038	J	~ PQL
<b>010502IW05WCS</b> <i>part.</i>	Aroclor 1254	0.032	U	Corrected PQL
<b>010502IW06WCS</b> <i>water</i>	Aroclor 1254	0.032	U	Corrected PQL
<b>010503IW10WCS</b> <i>water</i>	Aroclor 1254	0.031	U	Corrected PQL
<b>010503IW10WCS</b> <i>part.</i>	Aroclor 1254	0.032	U	Corrected PQL
<b>010503IW11WCS</b> <i>water</i>	Aroclor 1254	0.030	U	Corrected PQL
<b>010509IW28TS</b> <i>crayfish</i>	Aroclor 1254	75600	J	Surrogate R > 120%

## **METALS ANALYSES - U.S. EPA SW-846, Methods 6010B, 6020 & 7471A.**

Metals analyses were performed by Sound Analytical Services, Inc. (SAS) of Tacoma, Washington, in accordance with the requirements of the *Sampling and Analysis Plan, In-Water Investigation, Bradford Island Landfill*, April 2001 (URS) and referenced SOPs. The analytical SOPs are equivalent to and referenced as EPA SW-846 Method 6010B for analysis of barium (Ba), calcium (Ca), chromium (Cr), copper (Cu), iron (Fe), lead (Pb), magnesium (Mg), manganese (Mn), nickel (Ni), potassium (K), vanadium (V) and zinc (Zn); Method 6020 for analysis of antimony (Sb), arsenic (As), beryllium (Be), cadmium (Cd), cobalt (Co), selenium (Se), silver (Ag) and thallium (Tl); and Method 7471A for the determination of mercury (Hg).

Five river and five catch basin sediments, which include eight primary sample locations and two blind duplicates. Sample results are presented with associated data qualifiers in Table 4-6 and 4-15.

**Sample Documentation, Custody and Holding Conditions / Times:** All samples were handled and delivered to the laboratory according to chain-of-custody procedure. Laboratory data deliverables are well organized and generally complete. Maximum holding times for solids are specified as 28 days for mercury and 6 months for other metals. Holding conditions and times are determined to be acceptable. No results require qualification due to holding times and conditions.

**Initial Calibration:** The laboratory performed initial instrumental calibrations daily using at least the minimum required number of data points to establish the analytical curve for each method: a blank and one standard for ICP-AES analyses, a blank and five standards for ICP-MS analyses, and a blank and five standards for mercury analyses. Correlation coefficients for all mercury initial calibrations are  $\geq 0.995$ , as required.

**Initial Calibration Verification:** The laboratory performed initial calibration verification checks (ICVs) immediately after initial instrumental calibrations during all ICP and mercury analytical sequences, as required. All ICV recoveries are within acceptance limits (90–110% for ICP; 80–120% for mercury).

**Continuing Calibration Verification:** The laboratory analyzed continuing calibration verification standards (CCVs) at the required frequency for all ICP and mercury analytical sequences (at the beginning and end of each run; at a frequency of = 10% or every two hours, whichever is more frequent). All CCV recoveries are within acceptance limits (90–110% for ICP; 80–120% for mercury).

**Blanks:** Initial calibration blanks (ICBs) were analyzed immediately after ICVs, and continuing calibration blanks (CCBs) were analyzed immediately after CCVs during all ICP and mercury analytical sequences, as required.

Two preparation or method blanks were analyzed for all target analytes. Sb, Pb, Mn and Ni were detected at levels less than the PQLs. All associated sample results are qualified as nondetected at the associated values ("U" qualifier code).

No field rinsate blanks were submitted for analysis.

**Interference Check Samples:** ICP interference check solutions (ICS) were analyzed for the target analytes at the beginning of each ICP analytical run, as required by the individual methods. Recoveries for all required target analytes in all check samples are within acceptance limits (80–120%).

**Laboratory Control Samples:** Laboratory control samples (LCS) were analyzed at the required frequency (at least one sample per matrix per preparation batch). All LCS results are within 80–120% of known values.

**Duplicate Sample Analyses:** Laboratory duplicate samples were analyzed for the target analytes at the required frequency (at least one sample per matrix per preparation batch). Acceptance limits applied in this evaluation of duplicate sample analyses are as: Results = 5X the reporting limit, = 35% Relative Percent Difference (RPD) for solids; results < 5X the reporting limit  $\pm$  2X the reporting limit). Results of all duplicate analyses meet these criteria with the exception of manganese in one duplicate analysis of a sediment sample (010501SBMS01SS) (the other two duplicate pairs showed acceptable performance). Manganese in the associated sample only is qualified as estimated (“J”).

**Matrix Spike Sample Analyses:** Matrix spike samples were analyzed for the target analytes in three samples. Acceptance limits for matrix spike recovery are 75–125% and are applicable only to those samples and analytes for which the sample concentration does not exceed four times the spike concentration. Some recoveries were outside the acceptance range due to high native concentrations relative to spike levels. No results required qualification based on matrix spike performances.

**Reported Detection/Quantitation Limits:** Reported quantitation or lower reporting limits are within reasonable ranges and allow comparison to background and/or reference levels.

**Field Replicates:** Two blind field replicate sample pairs were submitted and analyzed for metals for determination of analytical variability. Sample results for replicate pairs are presented in the attached table. Greatest variability is associated with Pb and Ni in catch basin sediments; 90% and 95%, respectively. Comparability (or lack of) is not atypical of contaminated solids. No results are qualified due to blind duplicate analytical performance.

**Overall Assessment:** All deliverables required by the project are present and data packages are generally complete. All analyses meet recommended sample holding times. Initial calibration and calibration verification are acceptable. Sb, Pb, Mn and Ni were detected in method blanks at levels less than the PQL; affected results were qualified as nondetected at the associated values. Recoveries for interference check samples and laboratory control samples are acceptable. Laboratory duplicate sample analyses are acceptable with the exception of manganese (Mn) in one sediment analysis; associated positive results are qualified as estimated (“J”). Matrix spike recovery performances are within acceptable ranges. Reported quantitation or lower reporting limits are sufficient for comparison to background and/or proposed screening levels. Overall analytical performance is considered acceptable and the data quality is sufficient for project use.

Comparison of split sample analyses performed by the project lab and an independent reference lab is as follows (mg/kg, dry):

Analyte	010501SBMS01SS		010503IW14SS	
	Project lab	Ref. lab	Project lab	Ref. lab
Arsenic	3.6	4.4	2.4	3.6
Silver	0.26	1.0 U	0.16	1.0 U
Aluminum	9500	4810	11000	8210
Barium	76	45.1	88	88.8
Beryllium	0.14	0.17 J	0.27	0.45
Calcium	4000	3030	4200	4950
Cadmium	1.6	0.90	1.0	0.36 J
Cobalt	11	15.4	8.6	11.1
Chromium	87	540	16	19.8
Copper	43	45.1	27	23.6
Iron	28000	27900	18000	20400
Potassium	450 J	280	1100	739
Magnesium	6000	17400	4600	5530
Manganese	510 J	349	380	305
Sodium	-	300	-	400
Nickel	33	263	7.6	16.4
Lead	630	280	9.3	8.6
Selenium	0.72 U	4.0 U	0.7 U	4.0 U
Antimony	1.2	1.9 J	0.70 U	1.7 J
Thallium	0.032 J	6.0 U	0.16	6.0 U
Vanadium	50	42.3	44	54.8
Zinc	180	174	73	96.5
Mercury	0.063	0.016	0.035	0.028

A summary of qualified results is as follows:

Sample	Analyte	Value	Qualifier	Deviation
010501SBMS01SS	Manganese	510	J	High duplicate variability
	Potassium	450	J	< PQL
	Thallium	0.032	J	< PQL
010501SBMS02SS	Potassium	300	J	< PQL
	Beryllium	0.11	J	< PQL
	Selenium	0.39	J	< PQL
	Silver	0.11	J	< PQL
	Thallium	0.047	J	< PQL
010502IW01SS	Antimony	0.62	U	Blank contamination
	Selenium	0.26	J	< PQL
010502IW07SS	Antimony	0.72	U	Blank contamination
	Selenium	0.31	J	< PQL
	Silver	0.11	J	< PQL
010503IW14SS	Antimony	0.70	U	Blank contamination

<b>010503IW15SS</b>	Antimony	0.73	U	Blank contamination
<b>010503IW16SS</b>	Antimony	0.70	U	Blank contamination
	Mercury	0.017	J	< PQL
	Selenium	0.2	J	< PQL
<b>010503SBDS18SS</b>	Antimony	0.92	U	Blank contamination
<b>010503SBDS19SS</b>	Antimony	0.97	U	Blank contamination
	Beryllium	0.086	J	< PQL
	Mercury	0.021	J	< PQL
	Potassium	340	J	< PQL
	Selenium	0.19	J	< PQL
	Silver	0.099	J	< PQL
	Thallium	0.072	J	< PQL
<b>010504SBDS24SS</b>	Antimony	1.5	U	Blank contamination
	Mercury	0.034	J	< PQL

## **TOTAL ORGANIC CARBON (TOC) ANALYSES - U.S. EPA SW-846, Method 9060 & ASTM D4129-82M.**

TOC analyses were performed on fourteen sediments by Sound Analytical Services, Inc. (SAS) of Tacoma, Washington, in accordance with the requirements of the *Sampling and Analysis Plan, In-Water Investigation, Bradford Island Landfill*, April 2001 (URS) and SW-846 Method 9060. Analyses of six river sediments were analyzed for TOC by Columbia Analytical Services, Inc. (CAS) of Kelso, Washington, by ASTM Method D4129-82 (modified for solids). Sample results are presented with associated data qualifiers in Table 4-1 and 4-3.

**Sample Documentation, Custody and Holding Conditions / Times:** All samples were handled and delivered to the laboratory according to chain-of-custody procedure. Laboratory data deliverables are generally well organized and complete. Maximum holding times for solids are specified as 28 days at 4 °C. Holding conditions and times are determined to be acceptable for samples handled and analyzed by SAS. Holding times for samples analyzed by CAS are determined to be approximately 16 weeks. Holding conditions are reported to be as frozen samples while in the custody of Battelle Marine Sciences Laboratory for 15 weeks (regional guidance recommends a maximum holding time of one year at -20 °C). Results for samples handled by both SAS and CAS/Battelle require no qualification due to holding times and conditions. No results require qualification due to sample holding times and conditions.

**Calibration:** SAS performed initial instrumental calibration with a 1.0% standard and followed sample analyses with (what appears to be) verification standards at 0.5%, 0.2%, 5.0% and 6.0%. An NIST check sample showed a 93% and 95% recovery at a concentration of 3.35%. CAS did not document an initial calibration, however continuing calibration verifications were documented twice showing 96% and 98% recoveries at a concentration of 20.0%.

**Blanks:** Initial calibration blanks (ICBs) and continuing calibration blanks (CCBs) were analyzed and demonstrated no detections.

Method blanks were analyzed and reported by both labs. No detections were found above lower reporting limits.

**Laboratory Control Samples:** Laboratory control sample (LCS) results were submitted by CAS. LCS performance was 103% of the known value. SAS ran an NIST2704 check sample for each batch and reported a 93% and 95% recovery.

**Duplicate Sample Analyses:** A laboratory duplicate analysis was performed by CAS on sample 010502IW11SS. RPD was reported at 15%, well within the specification of = 35% Relative Percent Difference (RPD) for solids.

**Matrix Spike Sample Analyses:** One matrix spike analysis was performed by CAS on sample 010502IW11SS, which reported a recovery of 87%. Acceptance limits for matrix spike recovery are 75–125%. SAS performed three sets of MS/MSD analyses for TOC. Recoveries ranged from 98% to

117%, with RPDs ranging from 0.8% to 19%. No results required qualification based on matrix spike performances.

**Field Replicates:** Three blind field replicate sample pairs were submitted and analyzed for determination of monitoring variability. Sample results for replicate pairs are presented in the attached table. Greatest variability is associated with river sediments; 58% Diff (or RPD). This variability is consistent with the variability observed for other contaminants (PCBs) reported in the same sample. No results are qualified due to blind duplicate analyses.

**Overall Assessment:** All deliverables required by the project are present and data packages are generally complete. Sample holding times and conditions are determined to be acceptable. Initial calibrations and calibration verifications are acceptable. Method blanks showed no detections above lower reporting limits. LCS and matrix spike recovery performances are within acceptable ranges. Overall analytical performance is considered acceptable and the data quality is sufficient for project use.

Comparison of split sample analyses performed by the project lab and an independent reference lab is as follows (% , dry):

Analyte	010501SBMS01SS		010503IW14SS	
	Project lab	Ref. lab	Project lab	Ref. lab
TOC	1.2	1.1	0.29	0.17

The electronic laboratory deliverable is located in a separate folder on the CD for this report. Hard copies of all laboratory data sheets are stored at URS and are available on request.





# Technical Memorandum



To: URS Project File 52-00080001.00  
From: Chris Moody  
Date: December, 28, 2000  
Subject: In-water Waste Recovery Activities-  
Bradford Island Landfill

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This Technical Memorandum summarizes the field activities and observation made during the December 2000 waste recovery operations conducted in the Columbia River adjacent to the Bradford island Landfill at Bonneville Dam, Cascade Locks, Oregon. This work was performed in accordance with the procedures outlined in the "*Work Plan Bradford Island Landfill, In-water Waste Recovery Plan*", dated December 2000 and prepared by URS.

The primary objectives of this project were:

1. Remove the electrical items present in the Columbia River located proximate to the landfill.
2. Conduct additional underwater surveys, down river from the landfill toward the Bonneville Dam spillway, to determine whether additional waste-related items may be submerged.
3. Collect and analyze river sediment samples beneath or near each area where electrical items are located.
4. Collect and analyze river sediment samples near an outfall on the north side of Bradford Island.

The collection of the sediment samples was intended to assist in the evaluation of potential PCB impacts to river sediments near where PCB-containing equipment was discovered. Due to weather constraints, objectives 1 and 3 could only be partially completed. The weather also prevented the completion of the additional underwater survey and sampling near the outfall (objectives 2 and 4).

## **Schedule**

Recovery activities were performed on December 19-20, 2000. Recovery activities were planned to continue through December 22, 2000, however due to poor weather conditions (high winds and snow) USACE canceled the activities on these days.

## **Project Team**

The project team outlined in the work plan was the one utilized for the removal activities. The USACE coordinated field logistics with the dam operator, provided and operated a work boat from which the divers and the recovery operations were deployed, and directed its three contractors (URS, Foss Environmental [Foss], and Advanced American Diving [Advanced American]). Each team member's responsibilities were outlined in the Work

Plan. Matt McClincy, Department of Environmental Quality (DEQ) Project Manager for this voluntary cleanup program site, was present during all field activities.

### ***Waste Recovery***

Both days of recovery were spent recovering a portion of the electrical equipment from the area of concern on the eastern tip of Bradford Island. Materials were recovered in an area from the eastern most tip of the island, to approximately 50 feet to the northwest as measured along the shore of the island. Figure 1 depicts the areas of concern identified during the hydrographic and dive surveys, and the area addressed during this recovery effort.

The following four types of electrical equipment were recovered from this area:

- Post Insulators
- Lightening Arrestors
- Intereen Capacitor (one)
- Electrical panels (switches)

Photos of the items are included with this Technical Memorandum.

The post insulators, electrical panels, and lightening arrestors were recovered by having a diver place a cable attached to the winch on the boat around the item. The electrical panels were recovered by having a diver place a “U” bolt through a pre-existing hole on the panels. Once at the surface Foss placed these materials into a 1-yard bulk bag made of tight nylon mesh, and stored these bags on a barge provided by Advanced American located next to the work boat.

Only one intereen capacitor was discovered and removed. The capacitor was visible on the shore of the island and was recovered by having a diver wade out to the item, place a plastic bag around the item and bring it back to the barge. The capacitor was then placed into a DOT approved 55-gallon drum. The intereen capacitor was believed to contain PCB oil, based on analysis of oils contained in similar items recovered during the October-November 2000 underwater survey.

Once the recovery barge was full, it returned to the upstream mooring adjacent to the navigation lock and the items were off loaded into rolloff bins for characterization and offsite disposal by USACE. During recovery operations, an oil containment boom with an 8-inch float curtain was placed around the work zone.

The approximate horizontal coordinates of waste items recovered, as well as the location of sediment samples obtained were recorded using a differential global positioning system. Figure 1 depicts the locations where sediment samples were collected during these activities.

Table 1 summarizes the number of items recovered during the two days activities took place.

**Table 1**  
**Electrical Items Recovered**

<b>Item</b>	<b>Post Insulator</b>	<b>Lightening Arrestors</b>	<b>Intereen Capacitor</b>	<b>Electrical panels</b>
<b># Recovered</b>	10 + broken parts	16 + broken parts	1	30 + broken parts

The USACE is presently in the process of characterizing the electrical items to determine the appropriate method of disposal. A total of three 10-yard rolloff bins were filled with the post insulators, lightening arrestors and electrical panels.

### ***Sample Collection***

Sediment was unable to be collected using the planned method outlined in the Work Plan of using a manually-operated drive hammer due to the predominantly cobbly nature of the riverbed. As an alternative to the drive method, a jar was sent down with the diver and the diver placed sediment present between the cobbles into the jar under the water. A total of four samples were collected during the recovery activities. Two samples (Sample IDs 001219BIL02SD, and 001219BIL03SD) were collected near the area where the intereen capacitor was recovered (one beneath the capacitor and one approximately 10 feet from the capacitor). A third sample was recovered from a 5-inch round disk that had fell out of a broken lightening arrestor (Sample ID 001219BIL01SD). The fourth sample was collected from the back of an electrical panel (Sample ID 001220BIL04SD). Figure 1 depicts the locations where the sediment samples were collected.

The disk and the back of the panel had acted as a sediment trap, therefore these samples consisted mostly of fine sands and silt sized particles. The other two samples that were collected from the riverbed consisted mostly of medium sized sands, since the sampling method could not recover the finer grained material from these areas.

Each sediment sample collected was submitted for analysis for PCBs by EPA Method 8082, Total Organic Carbon by EPA Method 9060, and petroleum hydrocarbons by Oregon DEQ Method NWTPH-Dx.

Table 2 summarizes the analytical results from the investigation.

A total of 4 crayfish observed near electrical components were collected. The diver placed each crayfish into a ziplock plastic bag, which was triple bagged at the surface. The USACE has stored the crayfish in an on-site freezer at the Bonneville Dam for possible future evaluation or analysis.

**Table 2**  
**Analytical Testing**  
**Results for Sediment Samples**  
**Bradford Island Landfill**

Sample ID		001219BIL01SD	001219BIL02SD	001219BIL03SD	001220BIL04SD
Sample Date		12/19/00	12/19/00	12/19/00	12/20/00
Parameter	Units	Sediment in Lightening Arrestor Disk	Sediment Approximately 5' from Intereen Capacitor	Sediment Beneath Intereen Capacitor	Sediment in Electrical Panel
Aroclor 1016	mg/kg	0.16 U	0.12 U	0.12 U	0.13 U
Aroclor 1221	mg/kg	0.16 U	0.12 U	0.12 U	0.13 U
Aroclor 1232	mg/kg	0.16 U	0.12 U	0.12 U	0.13 U
Aroclor 1242	mg/kg	0.16 U	0.12 U	0.12 U	0.13 U
Aroclor 1248	mg/kg	0.16 U	0.12 U	0.12 U	0.13 U
Aroclor 1254	mg/kg	0.15 J C1	0.12 U	5 C1	8.3 C1
Aroclor 1260	mg/kg	0.16 U	0.12 U	0.12 U	0.13 U
DRH	mg/kg	43 U	31 U	29 U	32 U
RRH	mg/kg	86 U	62 U	58 U	64 U
TOC	mg/kg	10,000	370	1,900	1,500

Notes:

DRH-Diesel Range Hydrocarbons

RRH-Residual Range Hydrocarbons (oil)

TOC-Total Organic Carbon

All results reported as dry weight

Data Qualifiers:

U: The analyte was undetected at the stated value.

J: The analyte was positively identified, however this is an estimated value.

C1: This analyte was positively identified and underwent second column confirmation.

C O L U M B I A R I V E R



**AREAS OF CONCERN**  
BRADFORD ISLAND,  
BONNEVILLE DAM,  
COLUMBIA RIVER, OREGON

RECEIVED		DATE

5	OF	5	PAGES
SCALE: 1" = 35'	PROVISION		
DATED: DATE	DRAWN: DWH		
PROJECT: URS2006-0013	CHANGED: JLD		
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## Photographs from the Waste Recovery Activities-December 19-20, 2000



Recovery of a Post Insulator



Recovered Lightning Arrestors (on the left) and  
Post Insulators (on the right)



Recovering an Electrical Panel



Sediment Located in Disk From an Arrestor (sampled)





# Technical Memorandum



To: Paul Huebschman  
From: Chris Moody & Jeff Wallace  
Date: May 22, 2001  
Subject: Testing and Disposal of Retrieved Items - Bradford Island Landfill

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USACE contracted URS Corporation (URS) to conduct an additional investigation of the near-shore area of Bradford Island under Contract DACW57-99-D-0005 Delivery Order No. 0004, dated March 26, 2001. Section 3.7 of this DO specifies waste management activities required related to materials recovered during past dive work (i.e., electrical items), as well as the remaining drums in investigative-derived wastes generated during upland investigations. Waste management activities included review of available chemical data and other information regarding the wastes, supplemental testing and characterization as necessary, waste containerization, development of waste stream profiles, and assistance to the USACE with respect to preparation of hazardous waste manifests.

URS conducted a site reconnaissance on April 3, 2001 to inventory the wastes and obtain information needed to assist in performance of these waste management tasks. As noted above, two general waste streams have been generated, including:

- 1) Investigative-derived waste (IDW) from upland investigations conducted by TetraTech and URS between 1998 and 2000. This waste includes equipment decontamination fluids, soil cuttings from borehole drilling, drilling fluids, and well development and purge water.
- 2) Electrical equipment removed from the river near the landfill, including electrical light ballasts, lightning arrestors, electrical panels, and other items.

This memo describes URS's activities and presents our recommendations for management of each of the waste streams.

## **IDW Wastes**

IDW was generated during both the Site Inspection (SI) conducted in 1998 by TetraTech, as well as during the Supplemental Site Inspection (SSI) during 1999-2000 by URS. In accordance with URS' DO 0002, samples of the IDW were collected and analyzed; waste management was not addressed in that assignment.

Fourteen (14) samples of containerized IDW generated during the SI and SSI were collected and analyzed. A copy of the IDW sample locations, identification numbers, and analytical results are included as Attachment A. This information was presented in the SSI report (June 2000).

## *Soil Characterization*

Based on these results, three drums containing soil cuttings require off-site disposal. The contents of the remaining drums containing soil cuttings may be disposed of at the Bradford Island landfill. The soil cuttings associated with MW-4 (two drums) contained lead above the RCRA regulatory level (5 mg/L as measured by TCLP) therefore; these soils are regulated as

a characteristic (toxic) hazardous waste (40 CFR 261.24). These drums have been labeled as 06-IDW-#07 and 06-IDW-#08. The soil cuttings associated with MW-5 and SB-6 contained TPH above 100 mg/kg are therefore regulated as special waste (OAR-340-093-170). This drum has been labeled as drill cuttings-IDW14.

### *Soil Profiling*

Two separate waste profiles have been developed for off-site disposal of these materials, including one for the two drums of hazardous waste (lead) contaminated soils, and one for the drum of petroleum-contaminated soils. These profiles were developed with the assistance of personnel from ONYX Environmental, at the request of Brian McCavitt of the USACE. The profiles are included as Attachment B.

### *Liquid Characterization*

Several categories of liquid IDW have been generated during the upland investigations at the landfill, including decontamination fluids, well development and purge water, and drilling fluids. All are essentially water, with some entrained soil particulates and/or bentonite (clay), and have little or no contamination associated with them according to the available testing data.

Matt McClincy at the Department of Environmental Quality (DEQ), has indicated in an August 22, 2000 phone conversation with URS that given the low levels of contaminants found in these material, it can be discharged to the ground surface of the landfill. This information was conveyed to Mr. McCavitt via telephone on May 11, 2001, and in an electronic mail message dated August 25, 2000. A copy of the email is included as Attachment C.

### *Scheduling/Transportation*

The soil profiles were signed by Mr. McCavitt on May 18, 2001 and then were provided to the disposal facilities for profile approval. The drums will be disposed of at the Chemical Waste Management landfill in Arlington, Oregon. The profiles are currently awaiting approval by the disposal facility and will be scheduled for pick up and disposal following approval. Mr. McCavitt requested that URS schedule the transportation task with ONYX Environmental, and to arrange with Mr. Pat Hunter to sign the manifests for these wastes.

The drums will not require additional containerization prior to transportation, however they will need to be labeled, manifested and the vehicle will require placarding prior to transportation. URS will work with the USACE's preferred waste contractor (ONYX Environmental) to ensure proper labeling and placarding occurs.

The remaining drums of soil IDW and the drums of liquid IDW may be disposed of at the landfill by the USACE as scheduling allows.

## **Electrical Equipment**

Electrical equipment was generated during the SSI report (a light ballast was discovered during the seep sampling event in the Spring 2000) as well as during the subsequent dive

survey in November, 2000 and the recovery operations in December, 2000. The light ballast found during the seep sampling event and the equipment recovered during the dive survey in November were placed by the USACE into DOT approved 55 gallon drums for characterization and disposal. Characterization of the materials removed from the landfill and during the November dive was conducted by the USACE on November 11, 2000.

The electrical equipment generated during the December recovery operations was placed into "super sacks" and then these sacks were placed by the USACE into two 20-yard capacity roll-off bins. In accordance with DO 0003, USACE maintained responsibility for the management of these wastes.

Two profiles were prepared by the USACE for disposal of these materials by Mr. McCavitt. These profiles were prepared using the analytical results from the November 11, 2000 testing conducted by the USACE. One profile covered the non-hazardous debris, and one covers any PCB equipment that contains greater than 499 ppm of PCBs. Copies of these profiles are included in Attachment D.

URS understands that the two roll-off bins were disposed of by the USACE using the non-hazardous debris profile. However, during the site reconnaissance it was discovered that two super sacks that were not placed into the roll off bins had not disposed of and remained at the hazardous waste storage area on Bradford Island.

#### *Electrical Equipment Characterization*

The electrical equipment removed from the river and the landfill can be summarized into three waste streams based on TSCA regulations:

- PCB Capacitors
- PCB-Contaminated Electrical Equipment (ballasts)
- Non-hazardous electrical equipment (less than 50 ppm of PCBs)

PCB capacitors, regardless of level of contamination, are required to be disposed in an incinerator (40 CFR 761.60). The ballasts can be disposed in a landfill, if all the free-flowing liquid is removed from the ballast. Since the ballasts recovered thus far from the Bradford Island Site and inspected by the USACE did not contain free-flowing liquid, these may be disposed of at a hazardous waste (RCRA Subtitle C) landfill.

#### *Electrical Equipment Profiling*

Three separate waste profiles have been prepared for electrical equipment, including two for the PCB capacitors and ballasts, and one for the non-hazardous electrical equipment). The first two profiles were developed with the assistance of personnel from ONYX Environmental; the third profile was previously developed by Mr. McCavitt in December 2000. Copies of these profiles are included in Attachment E.

Based on the site reconnaissance and communication with Mr. McCavitt: Three drums contain capacitors, three drums contain ballasts and other debris, and three drums and two "super sacks" contain non-hazardous electrical debris.

#### *Scheduling/Transportation*

The profiles were signed by Mr. McCavitt on May 18, 2001 and then were provided to the disposal facilities for profile approval. The non-hazardous debris contained in the super sacks will be disposed of at the Columbia Ridge Landfill in Arlington, Oregon, and the drums containing the PCB capacitors will be incinerated at Waste management's facility in Texas. The remaining electrical equipment will be disposed of at the Chemical Waste Management landfill in Arlington, Oregon. The profiles are currently awaiting approval by the disposal facilities, and will be scheduled for pick up and disposal following approval. Again, Mr. McCavitt requested that URS schedule the transportation task with ONYX Environmental, and to arrange with Mr. Pat Hunter to sign the manifests for these wastes. URS anticipates that the PCB wastes and the IDW wastes will be able to be picked up at the same time.

The drums will not require additional containerization prior to transportation, however they will need to be labeled, manifested and the vehicle will require placarding prior to transportation. URS will work with the USACE's preferred waste contractor (ONYX Environmental) to ensure proper labeling and placarding occurs. The super sacks will require placement into a DOT approved container, prior to transportation.

### **Summary of Waste Management**

Five waste streams generated during the investigation and removal activities at the Bradford Island Landfill will require off-site disposal at three different disposal facilities, including:

#### Columbia Ridge Landfill-Arlington, Oregon

1. Two super sacks that contain non-hazardous electrical equipment.
2. The one drum of soil cuttings that contain TPH above the DEQ Special Waste level of 100 mg/kg.

#### Chemical Waste Management Incinerator- Port Arthur, Texas

3. Three drums that contain capacitors (the inerteen and coupling capacitors).

#### Chemical Waste Management Landfill- Arlington, Oregon

4. The two drums of soil cuttings that contain lead above the RCRA regulatory level of 5 mg/L.
5. The remaining electrical equipment (three drums), including the light ballasts.

Two waste streams generated during the investigation will be disposed of at the Bradford Island Landfill site:

1. The contents of the drums containing decontamination and drilling fluids (25 drums).
2. The contents of the remaining drums of soil cuttings not requiring off-site disposal (4 drums).

*Current Status*

As indicated above, the profiles for the waste streams requiring off-site disposal are currently pending approval from the identified disposal facilities. Once the approvals are obtained, URS will work with Mr. Brian McCavitt and Mr. Pat Hunter of the USACE to coordinate the manifesting, containerization and transportation of these waste streams.

The USACE may dispose of the other remaining wastes at the landfill, as scheduling allows. The information provided within this technical memorandum allows the USACE to select which drums of wastes generated during the investigation may be disposed at the Bradford Island landfill.

**ATTACHMENT A**  
**IDW Analytical Results Table**



**IDW Sample Results**  
Bradford Island Landfill  
Cascade Locks, Oregon

Sample Identification	Sample Location/Drum Label	Abbreviated Sample ID	Media	TCLP Metals (mg/L)	TPH (DRO/RRO/GRO) (ppm)	PCBs/Pesticides (ppm)
990921BIL01IDW	Drum 1 near test pit 8 (Tetra Tech, 1998)	01IDW	Decon Water	NA	2.1/4.3/0	None
990921BIL02IDW	Drum 2 near test pit 8 (Tetra Tech 1998)	02IDW	Decon Water	NA	0.24/0/0	None
990921BIL03IDW	Drum 3 near test pit 8 (Tetra Tech 1998)	03IDW	Decon Water	NA	0.55/0/0.1	None
990921BIL04IDW	Drum 4 near MW-1	04IDW	Decon Water	NA	2.7/12/0	None
990922BIL05IDW	MW3 (Drums 5 and 6)	05IDW	Soil Cuttings	None	None	None
990922BIL06IDW	MW4 (Drums 7 and 8)	06IDW	Soil Cuttings	25-Lead	390/1400/0	None
990922BIL07IDW	MW2 (Drums 9, 10, 11)	07IDW	Soil Cuttings	0.2-Barium	None	None
990922BIL08IDW	MW1 (Drums 12, 13, 14)	08IDW	Soil Cuttings	None	NA	NA
991007BIL09IDW	Drum 1 of 3 near MW2 (URS, 1999)	09IDW	Decon Water	NA	0.4/0/0	None
991007BIL10IDW	Drum 2 of 3 near MW2 (URS, 1999)	10IDW	Decon Water	NA	0.81/0/0	None
991007BIL11IDW	Drum 3 of 3 near MW2 (URS, 1999)	11IDW	Decon Water	NA	0.58/0/0.11	None
991007BIL12IDW	Piezometer DH2002Z drilling fluid (composite of 7 drums)	12IDW	Drilling Fluid	NA	1.1/0/0.1	None
991007BIL13IDW	Piezometer DH2002Z (Drum 8)	13IDW	Soil Cuttings	1.2-Barium/ 0.1-Lead	None	0.076-PCBs
991007BIL14IDW	MW5 and SB6 (URS, 1999)	14IDW	Soil Cuttings	0.6-Barium/ 0.01-Cadmium/ 0.7-Lead	130/540/47	0.14-PCBs/ 0.01-Alpha-Chlordane

**ATTACHMENT B**  
**IDW Waste Profiles**



**ONYX ENVIRONMENTAL SERVICES, LLC**5720C NE 121<sup>st</sup> Avenue, Suite 105, Vancouver, Washington 98682-6244☐ Recertification**WASTESTREAM INFORMATION PROFILE****CM0672**

Approval Code

TSDF requested ARL Technology requested STAB Generator No. 451420 Generator EPA No. OR01401132181. Generator Name US Army Corps of Engineers

Generator State No.

Address Bonnyville Lock and Dam

State Wastestream No.

City Cascade LocksState OregonCountry USAZIP 97014-0150SIC Code 4911Source A69Origin 1Form H302System Type M112. Waste Name Soil Contaminated with Lead

Lab or Waste Area

3. Process Generating Waste Clean up of Bradford Island Landfill4. Shipping Name RQ Hazardous Waste, Solid, n.o.sHazard Class 9 UNNA No. NA3071 PG III RQ num 10RQ Desc: 1 D0082DOT Desc: 1 Lead2345. Waste Codes D018

Wastewater

Non Wastewater

Sub Category

## 6. Physical and chemical properties

PH	Specific Gravity	Flash Point (F)	Solids	% ash
a < 2	a < 8	a < 80	% suspended	water solubility
b 2-5	b 8-10	b 80-100	% settleable	BTU/lb
c <u>X</u> 5-9	c 10	c 101-140	% dissolved	
d 9-12.5	d 10-12	d 141-200		
e > 12.5	e <u>X</u> > 12	e > 200	Free Liquid Range	0 to 0 %
exact	exact	f <u>X</u> no flash	exact	

## Physical State

s X solid  
 m semi-solid  
 l liquid  
 p pumpable semi-solid  
 f flowable powder  
 g gas  
 a aerosol  
 r pressurized liquid  
 d debris per CFR 261.45  
 n shape

## Hazardous Characteristics

a air reactive  
 w water reactive  
 c cyanide reactive  
 f sulfide reactive  
 e explosive  
 o oxidizing acid  
 p peroxide former  
 s shock sensitive  
 t temp sensitive  
 m polymerization/monomer  
 n carcinogen  
 i infectious  
 h inhalation hazard  
 /one: A, B, C, D

## Odor/Describe:

a none X  
 b mild  
 c strong  
 Halogens  
 Br % Bromine  
 Cl % Chlorine  
 F % Fluorine  
 I % Iodine

Layers: a multi-layered b bi-layered c X single phase

Viscosity	a high (syrup)	a high (syrup)	a high (syrup)
By	b medium (oil)	b medium (oil)	b medium (oil)
Layer:	c low (water)	c low (water)	c low (water)
	d solid	d solid	d <u>X</u> solid

Used oil y/n

☐ IROC < 1000 ppm  
☐ or > 1000 ppm

WIP NO. **562720**

## 7 Chemical Composition (M = Major Pollutant, O = Ozone Depleting Substance, U = Unhazardous Constituents, T = Toxic Chemical, C = Carcinogen)

Constituents	Range	Units	Constituents	Range	Units
Soil	98	100%			
Lead	25	ppm			
Plastic, PPH	0	25%			

Total Composition Must Equal or Exceed 100%

Other:

8 Is the wastestream being imported into the USA? Yes No ☒9 Does the wastestream contain PCBs regulated by 40CFR? Yes No ☒

PCB concentration \_\_\_\_\_ ppm

10 Is the wastestream subject to Benzene NESHAP Notification and Control Requirements? Yes No ☒

If yes, concentration \_\_\_\_\_ ppm

11 Is the wastestream subject to RCRA subpart CC controls? Yes No ☒

Volatile organic concentration, if known \_\_\_\_\_ ppmw

CC approved analytical method \_\_\_\_\_ Generator Knowledge ☒12 Is the wastestream from a CERCLA or state mandated cleanup? Yes No ☒

## 13. Container Information (Identify UN container marking if known)

Packaging: Bulk Solid \_\_\_\_\_ Type/Size: \_\_\_\_\_ Bulk Liquid \_\_\_\_\_ Type/Size: \_\_\_\_\_ Drum ☒ Type/Size: 551A2

Other \_\_\_\_\_

Shipping Frequency: \_\_\_\_\_ Units \_\_\_\_\_ Per Month \_\_\_\_\_ Quarter \_\_\_\_\_ Year ☒ One time \_\_\_\_\_ Other \_\_\_\_\_

## 14. Additional Information:

## GENERATOR CERTIFICATION

I hereby certify that all information submitted in this and all attached documents contains true and accurate descriptions of this waste. Any sample submitted is representative as defined in 40 CFR 261 Appendix I or by using an equivalent method. All relevant information regarding known or suspected hazards in the possession of the generator has been disclosed. I authorize sampling of any waste shipment for purposes of recertification.

Brian McCorrith  
NAME (PRINT OR TYPE)

541-324-4575  
PHONE

5-12-01  
DATE

[Signature]  
SIGNATURE

ECC  
TITLE

## FACILITY NOTIFICATION

If approved for management, ONYX has all the necessary permits and licenses for the waste that has been characterized and identified by this profile.

WIP NO. S62720

# ONYX ENVIRONMENTAL SERVICES, LLC

5720C NE 121<sup>st</sup> Avenue, Suite 105, Vancouver, Washington 98682-6244☐ Recertification

## WASTESTREAM INFORMATION PROFILE

Approval Code

TSD/ requested OWS Technology requested DLF Generator No. 453420 Generator EPA No. OR01401132181. Generator Name US Army Corps of Engineers

Generator State No.

Address Bonneville Lock and Dam

State Wastestream No.

City Cascade LocksState OregonCountry USAZIP 97014-0150SIC Code 4911Source A69Origin 1Form B302System Type M1322. Waste Name Soil Contaminated with TPH

Lab or Waste Area

3. Process Generating Waste Clean up of Bradford Island Landfill4. Shipping Name Non-Regulated Material per 40 and 49 CFR

Hazard Class

UN/NA No.

PG

EQ amt

EQ Desc.: 12DOT Desc.: 1. Oil Contaminated Soil2.3.45. Waste Codes None

Wastewater

Non Wastewater

Sub Category

### 6. Physical and chemical properties

PH	Specific Gravity	Flash Point (F)	Solids	% ash
a <u>&lt;2</u>	a <u>&lt;.8</u>	a <u>&lt;80</u>	% suspended	water solubility
b <u>2-5</u>	b <u>.8-1.0</u>	b <u>80-100</u>	% settleable	BTU/lb
c <u>X 5-9</u>	c <u>1.0</u>	c <u>101-140</u>	% dissolved	
d <u>9-12.5</u>	d <u>1.0-1.2</u>	d <u>141-200</u>		
e <u>&gt;12.5</u>	e <u>X &gt;1.2</u>	e <u>&gt;200</u>	Free Liquid Range <u>0</u> to <u>0</u> %	
<u>exact</u>	<u>exact</u>	f <u>X no flash</u>		

#### Physical State

#### Hazardous Characteristics

a <u>X solid</u>	a <u>air reactive</u>	a <u>shock sensitive</u>
m <u>semi-solid</u>	w <u>water reactive</u>	t <u>temp sensitive</u>
l <u>liquid</u>	c <u>cyanoide reactive</u>	m <u>polymerization/monomer</u>
p <u>pumpable semi solid</u>	f <u>sulfide reactive</u>	n <u>carcinogen</u>
f <u>flowable powder</u>	e <u>explosive</u>	i <u>infectious</u>
g <u>gas</u>	o <u>oxidizing acid</u>	h <u>inhalation hazard</u>
a <u>aerosol</u>	p <u>peroxide former</u>	Zone: A, B, C, D
r <u>pressurized liquid</u>		
d <u>debris per CFR 261.45</u>		
n <u>slurries</u>		

#### Odor/Describe

a none X  
b mild  
c strong

#### Halogens

Hr 0 % Bromine  
Cl 0 % Chlorine  
F 0 % Fluorine  
I 0 % Iodine

Layers a multi layered b bi-layered c X single phaseViscosity a high (syrup)By b medium (oil)Layer c low (water)d solida high (syrup)b medium (oil)c low (water)d solida high (syrup)b medium (oil)c low (water)d X solid

Used oil y/n

☐ HCM: <1000 ppm☐ or > 1000 ppmWIP NO. 562719

Chemical Composition: [M - Mixed Pollutant, O - Other Depleting Substance, U - Underlying Hazardous Constituent, I - Inert Chemical, C - Carcinogen]

C constituents			Constituents		
	Range	Units		Range	Units
Soil	98	100%			
TPH	540	ppm			
Plastic, PPE	0	2%			

Total Composition Must Equal or Exceed 100%

Other:

5. Is the wastewater being imported into the USA? Yes \_\_\_ No ☒6. Does the wastewater contain PCBs regulated by 40CFR? Yes \_\_\_ No ☒

PCB concentration \_\_\_\_\_ ppm

0. Is the wastewater subject to Benzene NESHAP Notification and Control Requirements? Yes \_\_\_ No ☒

If yes, concentration \_\_\_\_\_ ppm

1. Is the wastewater subject to RCRA subpart CC controls? Yes \_\_\_ No ☒

Volatile organic concentration, if known \_\_\_\_\_ ppmw

CC approved analytical method \_\_\_\_\_ Generator Knowledge ☒2. Is the wastewater from a CERCLA or state mandated cleanup? Yes \_\_\_ No ☒

13. Container Information (Identify UN container marking if known)

Packaging: Bulk Solid Type/Size \_\_\_\_\_ Bulk Liquid Type/Size \_\_\_\_\_ Drum ☒ Type/Size 551A2

Other \_\_\_\_\_

Shipping Frequency: Units \_\_\_\_\_ Per Month \_\_\_\_\_ Quarter \_\_\_\_\_ Year ☒ One Time \_\_\_\_\_ Other \_\_\_\_\_

14. Additional Information:

## GENERATOR CERTIFICATION

I hereby certify that all information submitted in this and all attached documents contains true and accurate descriptions of this waste. Any sample submitted is representative as defined in 40 CFR 261 - Appendix I or by using an equivalent method. All relevant information regarding known or suspected hazards in the possession of the generator has been disclosed. I authorize sampling of any waste shipment for purposes of recertification.

Brian McCavitt  
NAME (PRINT OR TYPE)

541-374-4575  
PHONE

5-18-01  
DATE

[Signature]  
SIGNATURE

ECC  
TITLE

## FACILITY NOTIFICATION

If approved for management, ONYX has all the necessary permits and licenses for the waste that has been characterized and identified by this profile.

WTP NO. 562719

## **ATTACHMENT C**

**E-mail conveying DEQ approval of discharge of liquid IDW wastes to the  
Bradford Island Landfill**

George Lukert

08/25/2000 07:40 AM

To: Paul.A.Huebschman@nwp01.usace.army.mil

cc: Jeffrey Wallace/Portland/URSCorp@URSCORP

Subject: Bradford Island - IDW

Paul,

I wanted to pass along some IDW information I received from DEQ. On Tuesday (8/22), I spoke with Matt McLincy to discuss disposal options for IDW water as part of our costing effort for Task Order 0003. During the conversation, I suggested to Matt that decon and IDW water could be used for dust suppression or discharged to the ground surface, given the low levels of contaminants observed during previous investigations. Matt agreed that purge water and decon water sampled during the SSI could be used for dust control during upcoming excavation operations or could be discharged to the ground surface. However, Matt doesn't want IDW waters discharged directly to the river or on top of the landfill so as not to create a "slug" of water passing through the landfill debris. I hope this is helpful.

Thanks,

George

## **ATTACHMENT D**

### **Previous Electrical Equipment Profiles**



**WASTE MANAGEMENT**  
Columbia Ridge, Hillsboro, Riverbend, Graham Road, Capitol, Wenatchee

# WASTE PROFILE SHEET TERMS & CONDITIONS

Profile Number: \_\_\_\_\_

Expiration Date: \_\_\_\_\_

Profile Addendum Attached?

☐ Yes ☐ No

Service Agreement on File?

☐ Yes ☐ No

This form is to be used to comply with the requirements of governmental waste screening criteria.

1. Generator/Site Name: US Army Corps of Engineers 2. SIC Code: 9999  
3. Site Address: Bonneville Lock & Dam 4. Site City: Cascade Locks  
5. Site State: OR 7. Zip Code: 97014 6. Site Country: \_\_\_\_\_  
8. Generator USEPA/Federal ID#: OR 0140113218 9. Site Phone: \_\_\_\_\_  
10. Customer Name: Foss Environmental 11. Customer Phone: 503-978-7274  
12. Customer Contact: K. Benedict 13. Customer FAX: 503-289-6568

1. Waste Description, Category: Ceramic, debris 3. Billing Address: Foss Environmental  
2. State Waste Code: N/A 5420 N. CAGGON Ave  
4. Process Generating Waste: ceramic electrical Portland, OR 97217  
equipment, circuit boards, plastic, debris  
5. Transporter/Transfer Station: Foss Environmental 6. Shipping Method: 20 yd Box  
7. Estimated Quantity (Weight & Vol.): ~10-15 yds per ☒ Job ☐ Year ☐ Other \_\_\_\_\_  
8. Delivery Date(s): 12/22/00  
9. Personal Protective Equipment Requirements: NONE  
10. Is this a US Dept. of Transportation (USDOT) Hazardous Material?  
☐ Yes ☒ No (If no, skip 10, 11 and 12) 11. Reportable Quantity: \_\_\_\_\_  
12. Hazard Class / I.D. #: \_\_\_\_\_ 13. Shipping Name: NON RCRA / NON DOT Regulated  
☒ Check if additional information is attached. Indicate the number of attached pages: 1

	Yes	No
1. Is the waste represented by this waste profile sheet a "Hazardous Waste" as defined by USEPA, Canadian, Mexican, State, or Provincial regulation?	<input type="checkbox"/>	<input checked="" type="checkbox"/>
2. Does the waste represented by this waste profile sheet contain regulated radioactive material or regulated concentrations of Polychlorinated Biphenyls (PCBs)?	<input type="checkbox"/>	<input checked="" type="checkbox"/> (~6ppm)
3. Does this waste profile sheet and all attachments contain true and accurate descriptions of the waste material?	<input checked="" type="checkbox"/>	<input type="checkbox"/>
4. Has all relevant information within the possession of the Generator and Customer regarding known or suspected hazards pertaining to the waste been disclosed to the Contractor?	<input checked="" type="checkbox"/>	<input type="checkbox"/>
5. Is the analytical data attached hereto derived from testing a representative sample in accordance with 40 CFR 261.20(c) or equivalent rules?	<input checked="" type="checkbox"/>	<input type="checkbox"/> N/A
6. Will all changes that occur in the character of the waste be identified by the Generator and disclosed to the Contractor prior to providing the waste to the Contractor?	<input checked="" type="checkbox"/>	<input type="checkbox"/>

1. Management Method: \_\_\_\_\_  
2. Designated Facility: \_\_\_\_\_ 3. Hours of acceptance: \_\_\_\_\_ ☐ N/A  
4. Precautions, Special Handling Procedures, or Limitations on Approval: \_\_\_\_\_

Generic Approval: ☐ Yes ☐ NoSpecial Waste Decision: ☐ Approved ☐ Disapproved

Sales Person: \_\_\_\_\_ Date: \_\_\_\_\_ Technical Manager: \_\_\_\_\_ Date: \_\_\_\_\_

GENERATOR AND CUSTOMER MUST READ AND SIGN REVERSE HEREOF INITIAL \_\_\_\_\_  
INITIAL \_\_\_\_\_





**ATTACHMENT E**  
**Current Electrical Equipment Profiles**

# ONYX ENVIRONMENTAL SERVICES, LLC

5720C NE 121<sup>st</sup> Avenue, Suite 105, Vancouver, Washington 98682-6244
☐ Recertification

## WASTESTREAM INFORMATION PROFILE

CM0673

Approval Code

SDF requested ARL Technology requested DLF Generator No 453420 Generator EPA No. OR0140113218

Generator Name US Army Corps of Engineers Generator State No. ...

Address Boggsville Lock and Dam State Wastestream No. ...

City Cascade Locks State Oregon Country USA ZIP 97014 0150

SIC Code 4911 Source A69 Origin 1 Form B302 System Type M132

1. Waste Name PCB Contaminated Electrical Equipment Lab or Waste Area ...2. Process Generating Waste Clean up of Bradford Island Landfill3. Shipping Name RQ Environmentally Hazardous Substances, SolidHazard Class 9 UNNA No. UN2315 PG II RQ amt 1RQ Desc.: 1.DOT Desc.: 1.5. Waste Codes X012

Wastewater

Non Wastewater

Sub Category

## 6. Physical and chemical properties

PH	Specific Gravity	Flash Point (F)	Solids	% ash
a <u>&lt; 2</u>	a <u>&lt; .8</u>	a <u>&lt; 80</u>	% suspended	water solubility
b <u>2 - 5</u>	b <u>.8 - 1.0</u>	b <u>80 - 100</u>	% settleable	BTU/lb
c <u>X 5 - 9</u>	c <u>1.0</u>	c <u>101 - 140</u>	% dissolved	
d <u>9 - 12.5</u>	d <u>1.0 - 1.2</u>	d <u>141 - 200</u>		
e <u>&gt; 12.5</u>	e <u>X &gt; 1.2</u>	e <u>&gt; 200</u>	Free Liquid Range	0 to 0 %
const	const	f <u>X no flash</u>	const	

## Physical State

s X solid

m ... semi-solid

l ... liquid

p ... pumpable semi-solid

f ... flowable powder

g ... gas

a ... aerosol

r ... pressurized liquid

d ... debris per CFR 261.45

u ... sharp

## Hazardous Characteristics

a ... not reactive

w ... water reactive

c ... cyanide reactive

f ... sulfide reactive

e ... explosive

o ... oxidizing acid

p ... peroxide former

s ... shock sensitive

t ... temp sensitive

m ... polymerization/monomer

n ... carcinogen

i ... infectious

h ... inhalation hazard

Zone A, B, C, D

## Odor/Describe:

a none X

b mild

c strong

## Halogens

Br ... % Bromine

Cl ... % Chlorine

F ... % Fluorine

I ... % Iodine

Layers: a ... multi-layered:b ... bi-layeredc X single phase

Viscosity

By

Layer

a ... high (syrup)

b ... medium (oil)

c ... low (water)

d X solid

a ... high (syrup)b ... medium (oil)c ... low (water)d X solida ... high (syrup)b ... medium (oil)c ... low (water)d X solid

## Used oil y/n

☐ HOC < 1000 ppm

☐ or > 1000 ppm

WTP NO. 562753

Chemical Composition [M = Marine Pollutant, O = Ozone Depleting Substance, U = Underlying Hazardous Constituent, I = TRI Chemical, C = Carcinogen]

Constituents	Range	Units	Constituents	Range	Units
Ballast	50	100%			
PCB	258 ppm				
Fuels	50	100%			
Fell	10	20%			

Total Composition Must Equal or Exceed 100%

Other:

1. Is the wastestream being imported into the USA?

Yes \_\_\_ No ☒ X

Does the wastestream contain PCBs regulated by 40CFR?

Yes ☒ X No \_\_\_

PCB concentration 258 ppm

0. Is the wastestream subject to Benzene NESHAP Notification and Control Requirements?

Yes \_\_\_ No ☒ X

If yes, concentration \_\_\_ ppm

1. Is the wastestream subject to RCRA subpart CC controls?

Yes \_\_\_ No ☒ X

Volatile organic concentration, if known \_\_\_ ppmw

CC approved analytical method Generator Knowledge ☒ X

2. Is the wastestream from a CERCLA or state mandated cleanup?

Yes \_\_\_ No ☒ X

3. Container Information (Identify UN container marking if known)

Packaging: Bulk Solid \_\_\_ Type/Size: CY Boxes Bulk Liquid Type/Size: Drum ☒ X Type/Size: 551A2

Other: \_\_\_

Shipping Frequency: Units 7 Per Month Quarter \_\_\_ Year ☒ X One time Other

4. Additional Information:

## GENERATOR CERTIFICATION

I hereby certify that all information submitted in this and all attached documents contains true and accurate descriptions of this waste. Any sample submitted is representative as defined in 40 CFR 261 - Appendix I or by using an equivalent method. All relevant information regarding known or suspected hazards in the possession of the generator has been disclosed. I authorize sampling of any waste shipment for purposes of recertification.

Brian McCavit  
NAME (PRINT OR TYPE)

541-374-4575  
PHONE

5-18-01  
DATE

[Signature]  
SIGNATURE

ECC  
TITLE

## FACILITY NOTIFICATION

If approved for management, ONYX has all the necessary permits and licenses for the waste that has been characterized and identified by this profile

WTP NO. 562753

# ONYX ENVIRONMENTAL SERVICES, LLC

5720C NE 121<sup>st</sup> Avenue, Suite 105, Vancouver, Washington 98682-6244☐ Recertification

## WASTESTREAM INFORMATION PROFILE

Approval Code

TSDF requested PTA Technology requested Incin Generator No. 453420 Generator EPA No. OR0140113218

1. Generator Name US Army Corps of Engineers

Generator State No.

Address Bonville Lock and Dam

State Wastestream No.

City Cascade Locks

State Oregon

Country USA

ZIP 97014-0150

SIC Code 4911

Source A69

Origin 1

Form B407

System Type M043

2. Waste Name PCB Contaminated Electrical Equipment

Lab or Waste Area

3. Process Generating Waste Clean up of Bradford Island Landfill

4. Shipping Name RQ Environmentally Hazardous Substances Solid

Hazard Class 9 UN/NA No. UN2315 PG II RQ amt 1

RQ Desc: 1

DOT Desc: 1 Polychlorinated Biphenyls

5. Waste Codes No 30

Wastewater

Non Wastewater

Sub Category

### 6. Physical and chemical properties

PH	Specific Gravity	Flash Point (F)	Solids	% ash
a < 2	a < 0.8	a < 80	% suspended	water solubility
b 2 - 5	b 0.8 - 1.0	b 80 - 100	% settleable	BTU/lb
c X 5 - 9	c 1.0	c 101 - 140	% dissolved	
d 9 - 12.5	d 1.0 - 1.2	d 141 - 200		
e > 12.5	e X > 1.2	e > 200	Free Liquid Range	0 to 0 %
exact	exact	f X no flash		

### Physical State

- ☒ solid  
☐ semi-solid  
☐ liquid  
☐ pumpable semi-solid  
☐ flowable powder  
☐ gas  
☐ aerosol  
☐ pressurized liquid  
☐ debris per CFR 261.4)  
☐ sharp

Layers: a multi-layered:

b bi-layered

c X single phase

Viscosity a high (syrup)

By b medium (oil)

Layer: c low (water)

d X solid

a high (syrup)

b medium (oil)

c low (water)

d X solid

a high (syrup)

b medium (oil)

c low (water)

d X solid

### Hazardous Characteristics

- a air reactive  
 w water reactive  
 c cyanide reactive  
 f sulfide reactive  
 e explosive  
 o oxidizing acid  
 p peroxide former  
 m shock sensitive  
 i temp sensitive  
 m polymerization/monomer  
 n carcinogen  
 i infectious  
 h inhalation hazard  
 Zonc. A, B, C, D

Color

### Odor/Describe:

- a none X  
 b mild  
 c strong

### Halogens

- Br % Bromine  
 Cl % Chlorine  
 F % Fluorine  
 I % Iodine

### Used oil y/n

- ☐ HOC <1000 ppm  
☐ or > 1000 ppm

WTP NO. 562718

Chemical Composition [M = Major Pollutant, O = Organic Depleting Substance, U = Underlying Hazardous Constituent, T = Toxic Chemical, C = Carcinogen]

Constituents	Range	Units	Constituents	Range	Units
Insulation Capacitors	50	100%			
PCB	20 %				
Coupling Capacitors	50	100%			

Total Composition Must Equal or Exceed 100%

Other:

1. Is the wastestream being imported into the USA?

Yes \_\_\_ No X

2. Does the wastestream contain PCBs regulated by 40CFR?

Yes X No \_\_\_PCB concentration 20,000,000 ppm

3. Is the wastestream subject to Benzene NESHAP Notification and Control Requirements?

Yes \_\_\_ No X

If yes, concentration \_\_\_ ppm

4. Is the wastestream subject to RCRA subpart CC controls?

Yes \_\_\_ No X

Volatile organic concentration, if known \_\_\_ ppmw

CC approved analytical method \_\_\_ Generator Knowledge X

5. Is the wastestream from a CERCLA or state mandated cleanup?

Yes \_\_\_ No X

6. Container Information (Identify UN container marking if known)

Packaging: Bulk Solid Type/Size: CY Boxes Bulk Liquid Type/Size: Drum X Type/Size: 551A2

Other: \_\_\_

Shipping Frequency: Units 7 Per Month Quarter X Year X One Time \_\_\_ Other \_\_\_

7. Additional Information

## GENERATOR CERTIFICATION

I hereby certify that all information submitted in this and all attached documents contains true and accurate descriptions of this waste. Any sample submitted is representative as defined in 40 CFR 261 - Appendix I or by using an equivalent method. All relevant information regarding known or suspected hazards in the possession of the generator has been disclosed. I authorize sampling of any waste shipment for purposes of recertification.

NAME (PRINT OR TYPE) Brian M. C. SmithPHONE 541-874-4525 DATE 5-18-01SIGNATURE [Signature]TITLE ECC

## FACILITY NOTIFICATION

I approved for management, ONYX has all the necessary permits and licenses for the waste that has been characterized and identified by this profile.

WIP NO. 562718





WASTE MANAGEMENT  
Columbia Ridge, Hillsboro, Riverbend, Graham Road, Capitol, Wenatchee

# WASTE PROFILE SHEET TERMS & CONDITIONS

Profile Number: \_\_\_\_\_  
Expiration Date: \_\_\_\_\_  
Profile Addendum Attached? ☐ Yes ☐ No

Service Agreement on File?

☐ Yes ☐ No

This form is to be used to comply with the requirements of governmental waste screening criteria.

Generator/Site Name: US Army Corps of Engineers 2. SIC Code: 9999  
Site Address: Bonneville Lock & Dam 4. Site City: Cascade Locks  
Site State: OR 7. Zip Code: 97014 6. Site Country: \_\_\_\_\_  
Generator USEPA/Federal ID#: OR 014043218 9. Site Phone: \_\_\_\_\_  
Customer Name: Foss Environmental 11. Customer Phone: 503-978-7274  
Customer Contact: K. Benedict 13. Customer FAX: 503-289-6568

Waste Description, Category: Ceramic, debris 3. Billing Address: Foss Environmental  
State Waste Code: N/A 5420 N. LAGOOD Ave  
Process Generating Waste: ceramic electrical Portland, OR 97217  
equipment, circuit boards, plastic, debris  
Transporter/Transfer Station: Foss Environmental 5. Shipping Method: 20 yd Box  
Estimated Quantity (Weight & Vol.): ~10-15 yds per ☒ Job ☐ Year ☐ Other \_\_\_\_\_  
Delivery Date(s): 12/22/00  
Personal Protective Equipment Requirements: NONE

10. Is this a US Dept. of Transportation (USDOT) Hazardous Material?  
☐ Yes ☒ No (If no, skip 10, 11 and 12)

11. Reportable Quantity: \_\_\_\_\_

12. Hazard Class / I.D. #: \_\_\_\_\_

13. Shipping Name: NON RCRA / NON DOT Regulated

\*Check if additional information is attached. Indicate the number of attached pages: 1

1. Is the waste represented by this waste profile sheet a "Hazardous Waste" as defined by USEPA, Canadian, Mexican, State, or Provincial regulation? ☐ Yes ☒ No
2. Does the waste represented by this waste profile sheet contain regulated radioactive material or regulated concentrations of Polychlorinated Biphenyls (PCBs)? ☐ Yes ☒ No (~6ppm)
3. Does this waste profile sheet and all attachments contain true and accurate descriptions of the waste material? ☒ Yes ☐ No
4. Has all relevant information within the possession of the Generator and Customer regarding known or suspected hazards pertaining to the waste been disclosed to the Contractor? ☒ Yes ☐ No
5. Is the analytical data attached hereto derived from testing a representative sample in accordance with 40 CFR 261.20(c) or equivalent rules? ☒ Yes ☐ No ☐ N/A
6. Will all changes that occur in the character of the waste be identified by the Generator and disclosed to the Contractor prior to providing the waste to the Contractor? ☒ Yes ☐ No

1. Management Method: \_\_\_\_\_  
2. Designated Facility: \_\_\_\_\_ 3. Hours of acceptance: \_\_\_\_\_ ☐ N/A  
4. Precautions, Special Handling Procedures, or Limitations on Approval: \_\_\_\_\_

Generic Approval: ☐ Yes ☐ No

Special Waste Decision:

☐ Approved

☐ Disapproved

Sales Person: \_\_\_\_\_

Date: \_\_\_\_\_

Technical Manager: \_\_\_\_\_

Date: \_\_\_\_\_

GENERATOR AND CUSTOMER MUST READ AND SIGN REVERSE HEREOF

INITIAL  
INITIAL